PB83-112789

Noise Reduction Retrofit for a 'New Look' GMC Transit Bus: Service Bulletin

Tri-County Metropolitan Transportation
District of Oregon, Portland

Prepared for

Urban Mass Transportation Administration
Washington, DC

Nov 81

U.S. Department of Commerce
National Technical Information Service
NTIS

PB83-112789

REPORT NO. UMTA-OR-06-0005-81-1

NOISE REDUCTION RETROFIT FOR A "NEW LOOK" GMC TRANSIT BUS

SERVICE BULLETIN

Michael C. Kaye

TRI-COUNTY METROPOLITAN TRANSPORTATION
DISTRICT OF OREGON
4012 S.E. Seventeenth Avenue
Portland, OR 97202

NOVEMBER 1981

FINAL REPORT

DOCUMENT IS AVAILABLE TO THE PUBLIC
THROUGH THE NATIONAL TECHNICAL
INFORMATION SERVICE, SPRINGFIELD,
VIRGINIA 22161

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION

URBAN MASS TRANSPORTATION ADMINISTRATION
Office of Technology Development and Deployment
Washington DC 20590

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF NOISE ABATEMENT AND CONTROL
Technology and Federal Programs Division
Washington DC 20460

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTA-OR-06-0005-81-1		PB83 112789

4. Title and Subtitle	5. Report Date
Noise Reduction Retrofit for a "New Look" GMC Transit Bus: Service Bulletin.	November 1981
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Michael C. Kaye	DOT-TSC-UMTA
9. Performing Organization Name and Address Tri-County Metropolitan Transportation* District of Oregon 4012 S.W. Seventeenth Avenue Portland, Oregon 97202	10. Work Unit No. (TRAIS) OR-06-0005 11. Contract or Grant No. OR-06-0005
12. Sponsoring Agency Name and Address U.S. Department of Transportation Urban Mass Transportation Administration 400 Seventh Street, S.W. Washington, D. C. 20590	13. Type of Report and Period Covered Final Report April 1980-November 1981 14. Sponsoring Agency Code URT-22

15. Supplementary Notes

*Co-sponsored with: U.S. Environmental Protection Agency
Office of Noise Abatement and Control
Technology and Federal Programs Division
Washington, DC 20460

16. Abstract

This document gives instructions on how to apply a noise treatment to a contemporary city transit bus without extensive structural alteration. Prototype anti-noise treatments of two conventional transit motorbuses were tested: a Flxible "New Look" and a GMC "New Look" model. Baseline bus configuration, noise ratings, and performance benchmarks are presented for a GMC model T8H-5307A transit bus, powered by a Detroit Diesel 8V-71N engine. Earlier, a Flxible model 111DC-D061 was similarly treated using the same concepts and much of the same hardware. The results are almost identical, showing the wide range of treatment applicability. This report gives instructions as to how GMC "New Look" model is retrofitted with a turbocharged 8V-71TAC engine and ancillary hardware. The instructions include the revision of the engine aspiration system for easier breathing, the lining of the engine compartment with an anti-noise blanket, and the silencing of the hiss of the compressed air system dryer. These instructions are complete with sources for manufactured components and raw materials and with mechanical drawings for components to be locally fabricated. Acoustics benefits and performance side-effects are given. One beneficial side-effect of turbocharging is the reduction of harmful exhaust emissions. Another beneficial side-effect is the conservation of fuel due to smaller injectors and reduced aspiration restriction. The information contained in this report is of interest primarily to transit bus operators wanting to reduce noise by practical means, and to government agencies, manufacturers, and planners concerned with noise reduction at a moderate cost of buses already in service. This report is the second in a series. The first is: Noise Reduction Retrofit for a "New Look" Flxible Transit Bus: Service Bulletin, September 1980, PB 80-226103, A04.

17. Key Words	18. Distribution Statement
Bus Noise; Diesel Engine Noise; GMC Transit Bus; "New Look" Transit Bus; Noise and Noise Control; Turbochargers; Urban Noise Abatement	Available to the Public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	64	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

FOREWORD

This document is an instruction: how to apply a noise treatment to a contemporary city transit bus without extensive structural alteration. Specifically addressed is the GMC Model T8H-5307A with a Detroit Diesel 8V-71N engine. Earlier, a Flxible® Model 111DC-D061 was similarly treated using the same concepts and much of the same hardware. The results are almost identical, showing the wide range of treatment applicability.

The information is of interest primarily to transit bus operators wanting to reduce noise by practical means, and to government agencies, manufacturers, and planners concerned with noise reduction at moderate cost of buses already in service.

Acoustic benefits and performance side-effects are given. One beneficial side-effect (because of turbocharging) is reduced harmful exhaust emissions. Another, because of smaller injectors and reduced aspiration restriction, is fuel conservation.

Acknowledgment is made of the special contributions made by Gary Brentano and Richard Woods of the Tri-County Metropolitan Transportation District of Oregon (Tri-Met) who managed the project.

The work has been directed by the U.S. Department of Transportation: James Campbell for the Urban Mass Transportation Administration and Robert L. Mason for the Transportation Systems Center.

NOTICES

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The contents of this report reflect the views of the Tri-County Metropolitan Transportation District of Oregon, which is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policy of the sponsors.

This report does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trademarks or manufacturers' names appear herein only because they are considered essential to the object of this document.

Conversion Table to SI Units

This publication uses customary English units for the convenience of engineers and others who use them habitually. The table below is for the reader interested in conversion to SI units. For additional information see:

(1) NBS LC1078, Dec., 1976, "The Metric System of Measurement".
(2) Z210.1-1976, "ASTM/IEEE Standard Metric Practice".

Quantity	To convert from	To	Multiply by
Length	inch	m (meter)	2.540×10^{-2}
	foot	m	3.048×10^{-1}
	mile	m	1.609×10^{3}
Area	in^2	m^2	6.452×10^{-4}
	ft^2	m^2	9.290×10^{-2}
Volume	in^3	m^3	1.639×10^{-5}
	ft^3	m^3	2.832×10^{-2}
	gallon	m^3	3.785×10^{-3}
Temperature	° F	° C	$t_{°C} = (t_{°F} - 32)/1.8$
T. difference	$\triangle t_{°F}$	K	$\triangle T_K = \triangle t_{°F}/1.8$
Mass	pound	kg	4.536×10^{-1}
	ounce	kg	2.835×10^{-2}
Pressure	psi	Pa	6.895×10^{3}
	in H_2O	Pa	2.488×10^{2}
	in Hg	Pa	3.386×10^{3}
	mmHg	Pa	1.333×10^{2}
Energy	Btu	J	1.055×10^{3}
	MBtu	J	1.055×10^{9}
	kWh	J	3.600×10^{6}
	ft • lbf	J	1.356×10^{0}
	kilocalorie	J	4.187×10^{3}
Power	Btu/h	W	2.931×10^{-1}
	hp	W	7.457×10^{2}
Flow	gal/min	m^3/s	6.309×10^{-5}
	ft^3/min	m^3/s	4.719×10^{-4}
Density	lb/ft^3	kg/m^3	1.602×10^{1}
	lb/gal	kg/m^3	1.198×10^{2}
Heat Capacity	Btu/(lb • ° F)	J/(kg • K)	4.187×10^{3}
	Btu/(ft^3 • ° F)	J/(m^3 • K)	6.707×10^{4}

TABLE OF CONTENTS

Introduction..... 1

Baseline Configuration..... 2

Preliminary Fixes..... 3

Turbocharged Engine Retrofit..... 4

Sound Absorptive Padding..... 7

Exhaust System..... 13

Oil Filters. etc..... 16

Air Intake Snorkle..... 17

Air Intake System..... 18

Cooling System..... 19

Air Dryer Hiss..... 20

Estimated Cost..... 21

Acoustics..... 22

Effects on Performance..... 26

Abbreviations..... 27

Appendixes

A. Purchase List..... 28

B. Specialty Suppliers..... 29

C. Tri-Met Drawings..... 30

LIST OF ILLUSTRATIONS

Figure		Page
1.	Noise Treated Bus	1
2.	Turbocharged Detroit Diesel City Coach 8V-71	4
3.	Anti-Noise Padding Fabrication Technique	8
4.	Muffler Jacket	9
5.	Rear Door Padding	10
6.	Radiator Padding	11
7.	A/C Compartment Padding	11
8.	Engine Compartment Padding	12
9.	Exhaust Pipe Passage Cover	13
10.	Exhaust System	14
11.	Crankcase Breather	16
12.	Holloway Snorkle Kit	17
13.	Air Intake System	18
14.	Air Dryer Silencing	20

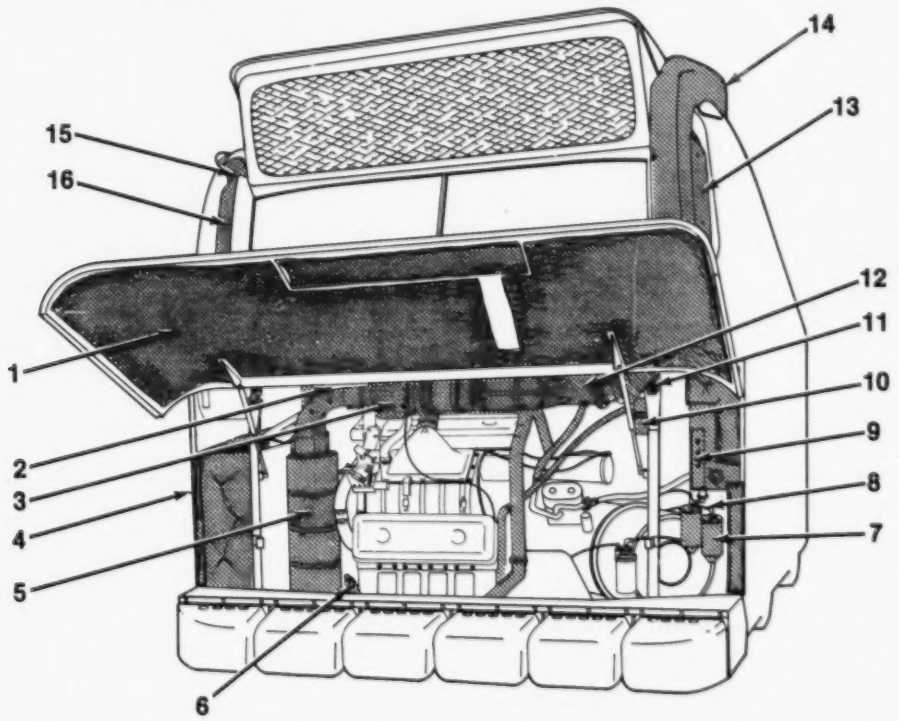
LIST OF TABLES

Table		Page
1.	Baseline Bus Characteristics	2
2.	Comparison of Key Engine Hardware When Converting an 8V-71N into an 8V-71TAC	5
3.	Changes to Engine Operation Due to Turbocharger Conversion	7
4.	Cost Estimate	21
5.	Noise Source Diagnosis Before and After Treatment	25
6.	Performance Benchmarks Before and After Treatment	26

INTRODUCTION

Owing to the general rise in prices for new vehicles, an operator might choose to extend the life of existing buses by renovation and remodeling instead of purchasing modern replacements. Noise treatments might well be included in such a program. Since fleets ordinarily consist of look-alikes having many small differences, this Instruction is designed to be of greatest utility by thoroughly documenting one good way to treat a typical bus. Highlights of the treatment are depicted in Figure 1. With this information, an experienced person can adapt the treatment to other bus models and expect similar results.

This approach unavoidably entails being specific about one set of suppliers and tradenames. There are a number of other products of equivalent quality and effectiveness. Regrettably, they cannot all be mentioned.



LEGEND

1 Engine compartment padding
2 Relocated surge tank
3 Jacketed turbocharger
4 Air dryer line
5 Jacketed muffler, relocated
6 Reworked oil filler tube
7 Relocated fuel filters, removed bypass oil filter
8 Relocated fuel lines
9 Relocated switch box
10 Crankcase breather
11 Lengthened hangers
12 More compact air cleaner
13 Blanked inlet
14 Snorkle
15 Exhaust stack with flex tube
16 Blanked screen

FIGURE 1
NOISE TREATED BUS

This, then, is an instruction for applying a noise treatment to a GMC Model T8H-5307A contemporary transit bus powered by a Detroit Diesel 8V-71N engine. Basically, the engine is replaced with a turbocharged version, the 8V-71TAC, requiring new intake and exhaust systems. The engine compartment is lined with anti-noise padding. There are no major structural alterations or seriously adverse side-effects. The intent is to make these changes when the engine is due for an overhaul and will be dismounted.

BASELINE CONFIGURATION

The engineering work that led to this Instruction was done by Tri-Met in Portland, Oregon. Table 1 lists the important characteristics of the bus before it was modified.

TABLE 1.

BASELINE BUS CHARACTERISTICS

Coach Make	General Motors
Coach Model	T8H-5307A
Built	1973
Engine Make	Detroit Diesel 8V-71N
Engine Model	7087-4021 City transit type 43° layover clockwise rotation as viewed from flywheel
Injectors	71C5
Fuel	#1 Diesel
Transmission	Allison VS2-8, 1.04:1, .72:1
Length	41'
Width	102"
Seats	49
Weight	23,780 lbs.
Axle Ratio	5 1/7 : 1
Tires	12.5 x 22.5 bias ply, 100 psi, 490 rev/mile
Air Conditioner	Roof-mounted condenser
Exhaust System	4" tubing with EIP Aspirator
Muffler	Nelson T-10853
Air Cleaner	Donaldson EBA 13-0026
Pre-separator	Donaldson PVH 000885
Fan	Schwitzer A-911153 (28" dia, 8-blades, notched)
Radiator Core	1,048 in^2, 11 fins/inch, 222 tubes in 4 rows
Shroud	30" dia, sheet metal
Fan Drive	GMC Torus
Engine Speed at Stall	1,250 rpm
1st Upshift Engine Speed	1,750 rpm at full throttle
1st Upshift Road Speed	25 mph

PRELIMINARY FIXES

Tri-Met's buses are relatively quiet to begin with when compared to those of many other transit systems. Other operators may be able to bring their bus noise down by doing what Tri-Met has already done and by paying attention to critical repair items.

1. Derate the engine by using the *smallest available injectors:* 71C5 (equivalent to 50 mm). This will reduce full throttle engine and exhaust noise. It is not practical to reduce noise by downsetting the overspeed governor. The transmission automatically upshifts before the engine speed exceeds 1,800 rpm. Downsets to lesser speeds would overly inhibit the bus's performance. Tri-Met uses small injectors and #1 Diesel to reduce exhaust smoke. Diesel #1 can slightly reduce full throttle engine and exhaust noise since it has about 4% less heat value per gallon.

2. Have a *modulated speed fan drive* such as the standard GMC Torus hydraulic clutch or the Schwitzer Viscous clutch. This minimizes average fan noise. An on-off fan clutch is not as satisfactory, but is better than a fixed drive. Tri-Met uses automatic fan drives for improved fuel economy.

3. Prevent unnecessary exhaust noise by making sure there are no *exhaust leaks* between the engine and the muffler outlet and that the *muffler is adequate.* Joints frequently break open because there is extensive stress caused by intermotion between the engine and the muffler. Provide an *intermediate flexible tube* section to relieve stress.

4. Keep the air side of the *radiator core clean.* Make sure the lower part of the *fan shroud is not left off.* Keep the *fan centered in the shroud.* These items minimize average fan speed, and thus fan noise, where there is an automatic fan drive. Also, the parasitic fan load on the engine is lessened, releasing more power to the wheels and reducing fuel consumption.

5. Adjust the transmission first *upshift speed to the low end* of its range: 22 mph. This reduces peak overall noise and improves fuel mileage with negligible loss of performance.

6. Keep *bellypans* in place. To reduce maintenance cost, Tri-Met does not use these optional engine compartment floors. However, operators who choose to use them can expect reduced engine noise generally and reduced fan noise on the right side. Although louvered sheet metal bellypans are not as acoustically effective as they could be, they are of some benefit.

7. Replace the 3 sets of synthetic *rubber engine mounts* when they fail, especially the donut-shaped mounts where the engine cradle connects to the chassis. If this is not done, engine vibration will telegraph more strongly into the bus body and the fan will move off-center in the shroud.

8. Repair *body rattles.* Keep in good working order the various handles and holddowns to compartment doors. Tri-Met favors the spring-loaded struts that facilitate the opening and closing of the rear engine compartment door. Interior noise level is controlled by eliminating rattles from windows and seats.

TURBOCHARGED ENGINE RETROFIT

A turbocharger will reduce both engine noise and exhaust noise. Engine noise is reduced due to softening of the abrupt increase in the rate of cylinder pressure rise at the onset of ignition during the compression stroke. Exhaust noise is reduced since the drive turbine reflects and scatters the impinging sound waves.

The original motivation behind supercharging engines by means of an exhaust turbine (turbocharger) was to increase power output without increasing engine size. (The 8V-71TAC is rated as high as 350 hp with 75 mm injectors.) Figure 1 shows a turbocharged 8V-71 city coach engine. Turbocharging also compensates for rarified air at higher altitudes.

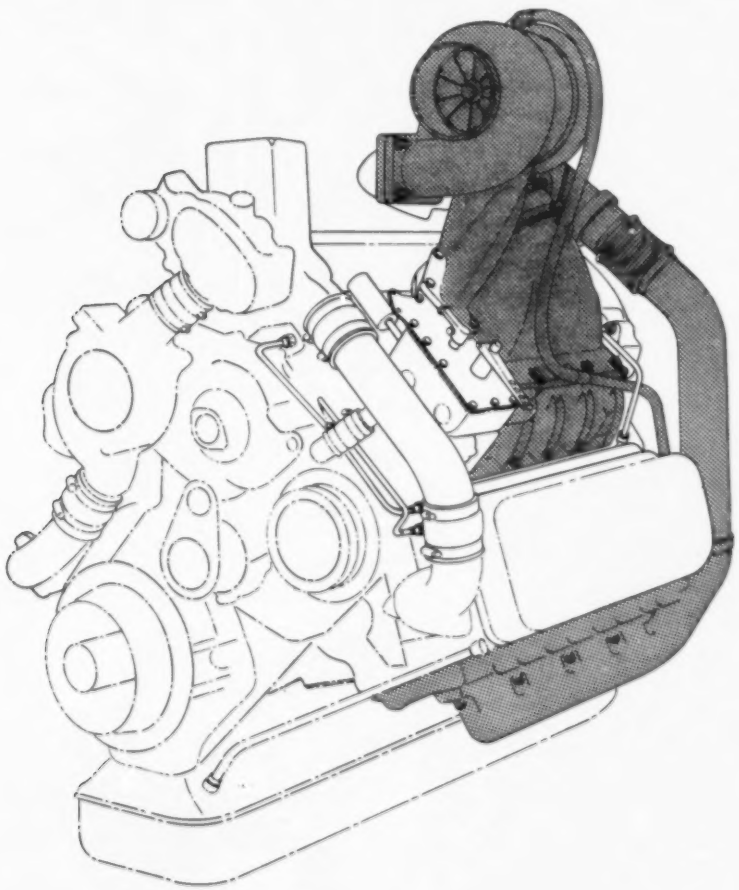


FIGURE 2
TURBOCHARGED DETROIT DIESEL CITY COACH 8V-71

The turbocharger captures escaping energy from the exhaust pipe and returns it to the engine in the form of denser intake air. This enables more fuel to be burned and thereby more power to be produced.

The effect can be intensified with an "aftercooler" which cools the compressed intake air, making it even more dense. The 8V-71TAC engine is equipped with an aftercooler located in the vee of the block.

Turbocharging reduces harmful gaseous exhaust emissions and can slightly improve fuel efficiency. Practically all diesel engines manufactured in the U.S. will be turbocharged in the future to satisfy clean air regulations.

Although turbocharging provides more air, thus allowing more fuel to be burned, it is inconsistent with noise control to unnecessarily increase fuel input along with a turbocharged engine retrofit. Consequently, injectors are sized up no more than to maintain satisfactory acceleration performance.

When diesel engines are turbocharged, the compression ratio is reduced in order to prevent overstress. This, coupled with the rotary inertia of the turbine wheel, results in reduced acceleration response. On the other hand, maximum power output during sustained effort probably increases. An available compensation for slower acceleration is reduction of throttle delay setting to the point of unwanted exhaust smoke.

TABLE 2.

COMPARISON OF KEY ENGINE HARDWARE
WHEN EXCHANGING AN 8V-71N FOR AN 8V-71TAC

	Item	8V-71N	8V-71TAC
1	Engine Model	7087-4021	7087-4623
2	Compression Ratio	18.7 : 1	17 : 1
	Valves & Valve Inserts	Inconel X	[3] Nimonic 90
4	Blower Drive Ratio	2.05 : 1	1.95 : 1
5	Blower Seals	Lip	Ring
6	Throttle Delay	.454"	.486"
	Injectors	71C5	7A55
7	Injector Timing	1.484"	1.460"
	Turbocharger	None	TV-7101 5101509 A/R 1.23
	Exhaust Manifold, Crossover Pipes, and Blower Inlet	N Type	Turbo Type

Notes to Table 2

1 These model numbers apply to a CMC city coach with a 43° layover.

2 Compression ratio is reduced to prevent overstressing the engine since the manufacturer anticipates more fuel, more cylinder pressure (BMEP), and more power. The improved crosshead pistons will enhance engine life.

3 Built to withstand possibly higher temperatures of turbocharged engines.

4 Since the turbocharger builds up ample air box pressure, scavenging blower is slowed to the minimum to save parasitic power loss. The blower is still needed to purge spent gases of combustion during situations when the turbocharger is lagging and not up to speed.

5 Improved seal needed to withstand higher air box pressures.

6 With turbocharging, there is a tendency for a puff of smoke to occur at the onset of full throttle acceleration. Adjustment of the throttle delay corrects this.

7 Reducing compression ratio tends to make the engine harder to start. Compensating adjustment is made to injector timing. If hard starting is still a problem in adverse weather, an ether cup installed on the dirty side of the air cleaner is recommended.

The engine should have die-cast aluminum valve covers and a block-mounted crankcase breather pad.

Table 3 lists the changes in engine operating characteristics caused by turbocharging.

After the engine is installed and checked for proper operation, check the turbocharger's functioning by measuring the pressure in the air box while the engine is under full throttle. Rather than rely on the idiosyncrasies of a chassis dynamometer, a simple, repeatable test is to drive the bus up a steady grade at full throttle, accelerating slowly, and note the air box pressure 100 rpm before top speed is reached. Pressures up to 25 psi can be expected. This baseline reading can be used later for verification if the turbocharger's performance is suspected of having fallen off.

With turbochargers, one must not allow exhaust back pressure to exceed allowable limits and one must guard against any exhaust gas leakage past manifold gaskets, joints, or through cracks in the exhaust system upstream from the power turbine. This will weaken their propulsion. Also, it is important not to let air cleaner filter elements load up with dirt past the allowable restriction limits.

TABLE 3.

CHANGES TO ENGINE OPERATION
DUE TO TURBOCHARGING
(Relevant to 2,000 rpm, full throttle, and #1 Diesel)

Item	Units	8V-71N (71C5)	8V-71TAC (7A55)
[1] Allowable exhaust back pressure	"Hg	6	3
[1] Allowable intake restriction	"H^2O	25	20
[2] Air Flow	CFM	830	1,066
[3] Water Flow	GPM	123	123
[4] Heat Rejection to Coolant	BTU/min	6,322	9,000
[5] Output	BHP	218	245
[6] Fuel Efficiency	lbs/BHP-hr	.394	.386
Peak Torque	ft-lbs	660	792
	rpm	1,200	1,200
Exhaust emissions NO_2	PPM	1,150	510
HC	PPM	153	121½
CO	PPM	140	160

[1] Sensitivity of turbocharger to aspiration restriction is reflected in more stringent limits set by the engine manufacturer.

[2] Reflects supercharging effect of turbocharger.

[3] No change to water pump.

[4] Heavier load on cooling system due to higher cylinder temperatures and after-cooler.

[5] One size larger injectors for maintaining acceptable acceleration performance.

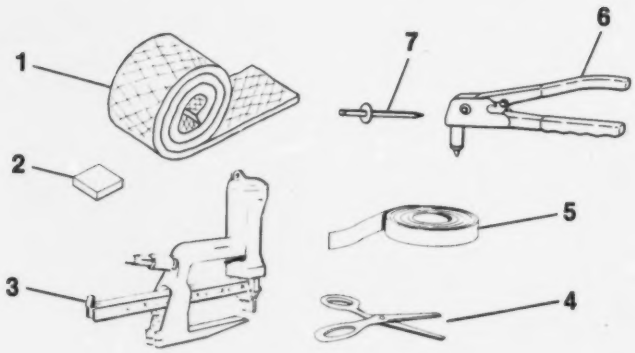
[6] No significant change to BSFC when converting an 8V-71N to an 8V-71TAC, but state-of-the art turbocharged diesels do have improved fuel efficiency.

SOUND ABSORPTIVE PADDING

The engine compartment is padded with 1½ inch thick material that is soft, rugged, and easily bent. It consists of a 10 oz/ft^2 lead septum sandwiched between two blankets of glass fiber. The composite is protected by a light-weight waterproof aluminized glass cloth. The lead serves as a sound barrier and the glass fiber blankets reduce echoing. It can be steamcleaned and is incombustible.

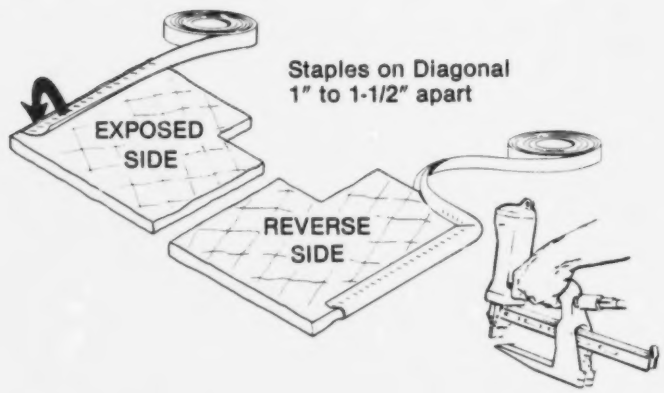
After cutting to size with ordinary hand shears (die cut in mass production), the fabricator binds the edges by stapling on an aluminized glass cloth edging tape (AGE) as shown in Figure 3. The pads are held in place with blind rivets through large diameter washers.

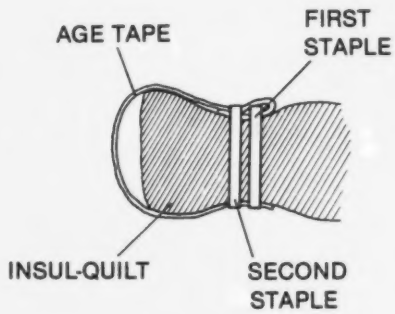
STEP 1
Gather tools, materials, and cut panels to size.



LEGEND
1 Insul-Quilt, type 6
2 1/2" x 5/8" Staples
3 Bostitch pneumatic stapler
4 Shears
5 3" AGE tape
6 Rivet gun
7 AD66BSLF Pop rivet

STEP 2
Staple tape along edge, then roll tape over staples and around edge of panel.





DETAIL SECTION

STEP 3
Turn panel over and staple tape on reverse side.

FIGURE 3
ANTI-NOISE PADDING FABRICATION TECHNIQUE

The padding is placed on all flat areas or single curvature surfaces that are not subject to removal for routine service operations.

Figure 4 illustrates the muffler jacket. It is lined with two layers of ceramic cloth for thermal protection and held in place with ½" wide steel bands applied by the strapping apparatus ordinarily found in Shipping Departments. This jacket stops muffler shell noise, reduces echoing of fan and engine noise, and procects maintenance personnel from accidental burns.

LEGEND
1 10″ x 15″ Oval muffler
2 Edging tape
3 Two layers ceramic cloth lining 26″ x 44″
4 26″ x 44″ anti-noise pad
5 1/2″ Steel strap

REFER TO DWG: SKA-B-10003B

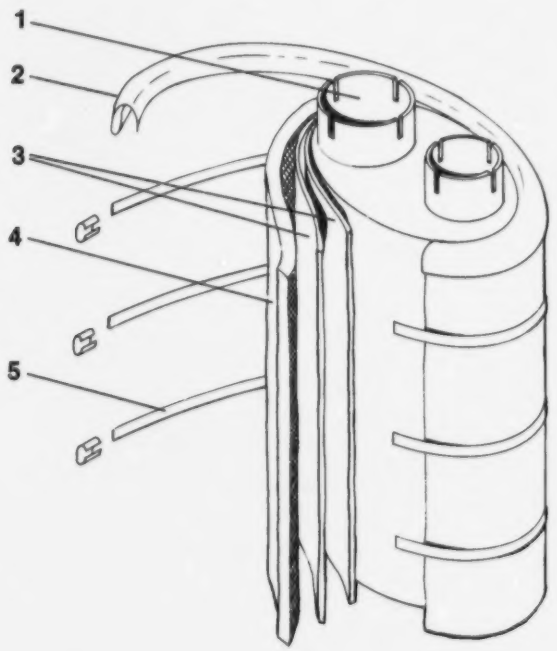
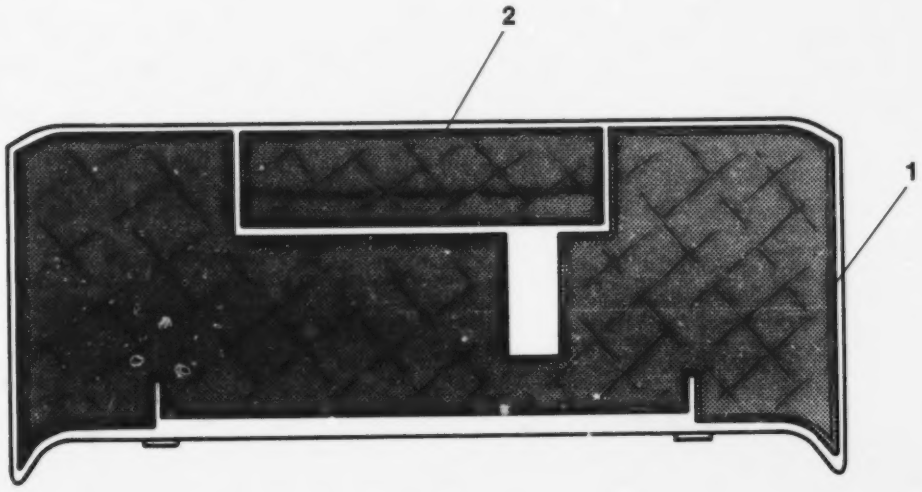


FIGURE 4
MUFFLER JACKET

Figure 5 dimensions and locates the anti-noise pads that fit onto the rear door to the engine compartment.

Before riveting pads to the rear door, remove lamp holders and attach crimped screw holders to the screw holes on the door. Lamps can thereafter be removed and serviced from the outer side of the door without requiring access to the nuts on the inside.

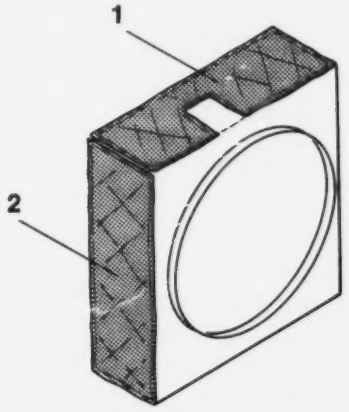


LEGEND
1 SK-B-10031-1
2 SK-B-10031-2

REFER TO DWG: SKI-B-10031

FIGURE 5
REAR DOOR PADDING

Figure 6 dimensions and locates the two pads that fasten to the radiator assembly and rear edge of the grille.

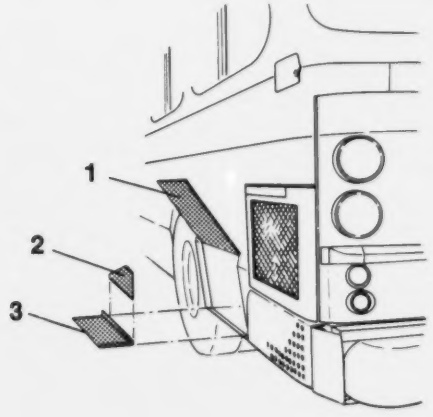


LEGEND
1 SK-B-10028-1
2 SK-B-10028-2

REFER TO DWG: SKI-B-10028

FIGURE 6
RADIATOR PADDING

Anti-noise pads are installed in the air conditioner compressor compartment on the left side of the bus, as shown in Figure 7. The door pad is riveted in place. The compressor compartment floor is simply laid down.

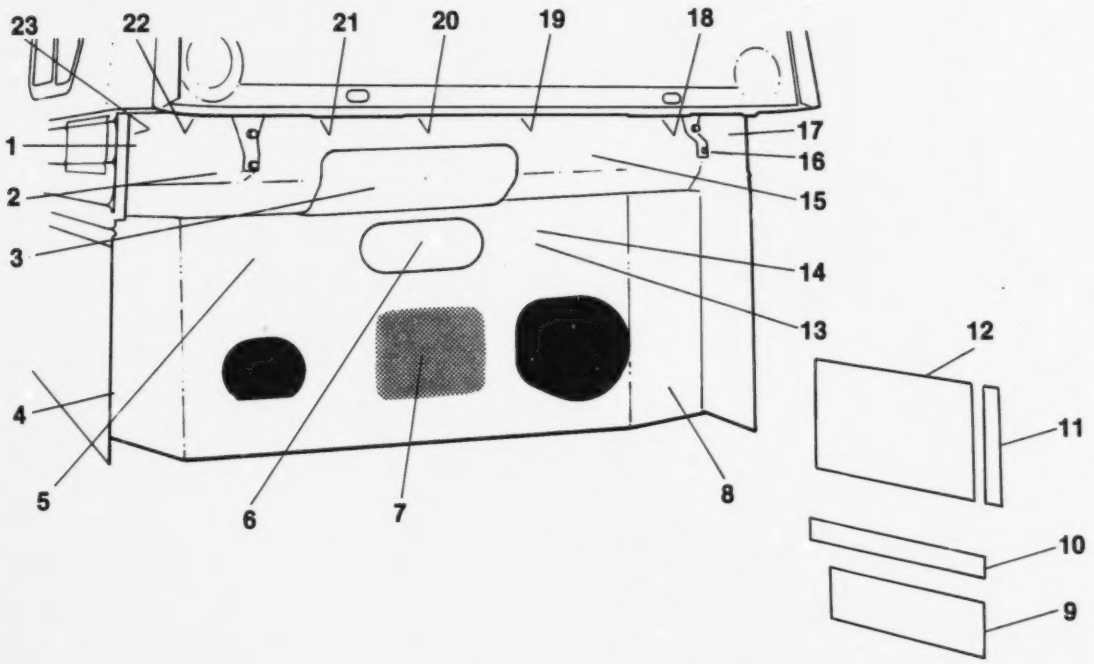


LEGEND
1 SK-B-10032-1
2 SK-B-10032-2
3 SK-B-10032-3

REFER TO DWG: SKI-B-10032

FIGURE 7
A/C COMPARTMENT PADDING

Anti-noise pads are riveted to the engine compartment firewall, rear seat pan, overhead, and door skirt. Beforehand, the OEM sound absorptive lining of glass fiber batts behind perforated aluminum screens is removed. The numerous mounting brackets, wire harnesses, and hose clamps are detached from these surfaces and reattached over the pads. These pads are depicted in Figure 8. For thermal protection from the engine's right hand exhaust branch, heat pad SK-A-10030 is fastened over the anti-noise padding on the rear seat pan.



LEGEND

1 SK-B-10051-2	9 SK-B-10047-4	17 SK-B-10047-5
2 SK-B-10049-2	10 SK-B-10047-3	18 SK-B-10050-1
3 SK-B-10049-4	11 SK-B-10047-2	19 SK-B-10050-4
4 SK-B-10051-1	12 SK-B-10047-1	20 SK-B-10050-2
5 SK-B-10048-1	13 SK-A-10030	21 SK-B-10050-3
6 SK-B-10048-2	14 SK-B-10048-3	22 SK-B-10050-5
7 SK-B-10048-5	15 SK-B-10049-3	23 SK-B-10049-1
8 SK-B-10048-4	16 SK-B-10047-6	

REFER TO DWGS: SKI-B-10033
SKA-B-10030
SK-B-10047
SK-B-10048
SK-B-10049
SK-B-10050
SK-B-10051

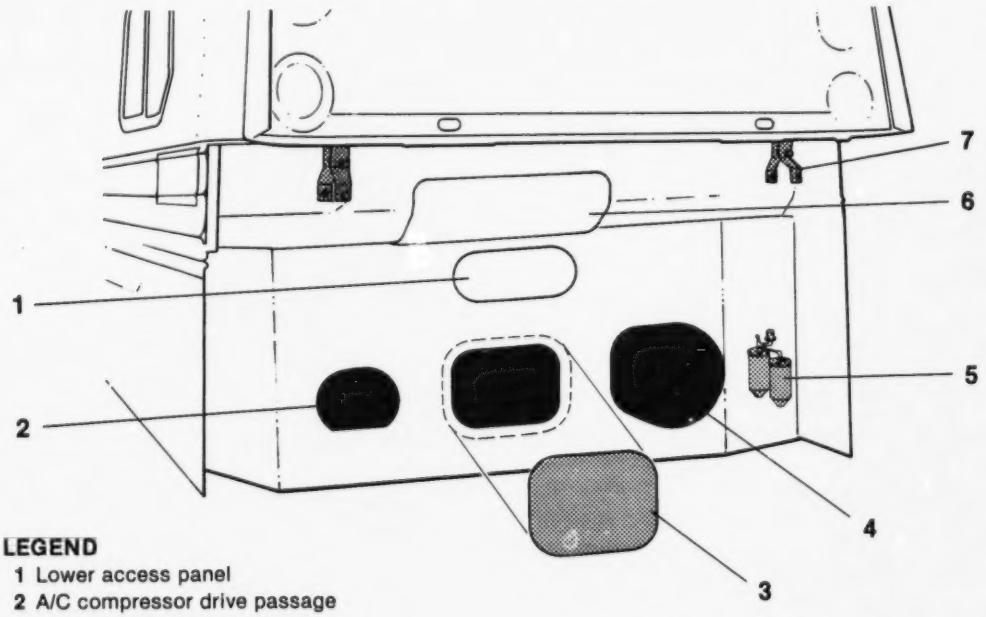
FIGURE 8
ENGINE COMPARTMENT PADDING

EXHAUST SYSTEM

A new exhaust system is installed in order to provide the reduced back pressure required by the turbocharger (Table 3). The main changes are:

	Before	After
Tube size to muffler	4" diameter	4" diameter
Exhaust muffler	Nelson T-12023-F	Donaldson WOM12-083, modified
Tube size to stack	4" diameter	5" diameter
Exhaust aspirator	EIP Kit	Removed
Stack tube size	4" diameter	4" diameter

The original exhaust tubing and muffler system from engine to outlet is removed. Before anti-noise padding is installed in the area, their old passageway through the center of the firewall is covered with an aluminum plate as shown in Figure 9.



LEGEND

1 Lower access panel
2 A/C compressor drive passage
3 Newly fabricated exhaust pipe passage blank
4 Drive line passage
5 Fuel filters
6 Rear seat access hatch
7 Lowered cradle hangers

REFER TO DWGS: SK-B-10029
SK-B-10034
SK-B-10041

FIGURE 9
EXHAUST PIPE PASSAGE COVER

Figure 10 depicts the new exhaust system. It features a new, smaller oval-shaped muffler. The muffler is relocated to the space between the engine and radiator formerly occupied by the "aspirator", a component of the so-called "Environmental Improvement Kit". The function of the aspirator was not replaced because it served no useful purpose to begin with. Also removed and replaced is the pinched terminus meant to be a "diffuser".

There is a plastic cowl located to the left of the rear window whose purpose is to conceal the stack. Its screen is removed and replaced with a 16-gage aluminum blank cut to fit. A flexible tube section in the stack relieves stresses in the exhaust tubing produced by intermotion between the engine and the chassis. Due to insufficient room, the 5" diameter pipe leading away from the muffler is reduced to 4" diameter as it travels upward through the stack well.

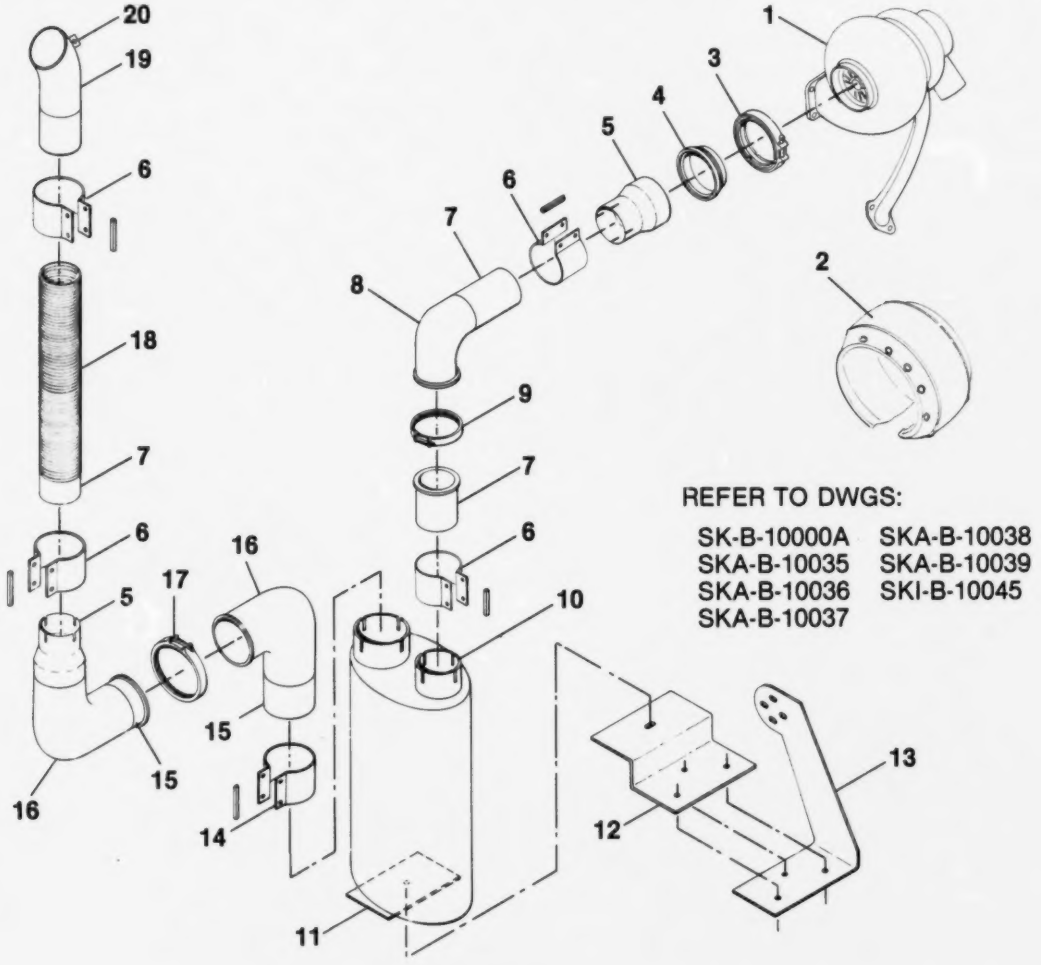


FIGURE 10
EXHAUST SYSTEM

LEGEND FOR FIGURE 10

1 Detroit Diesel TV-7101 turbocharger
2 Hitco turbocharger blanket 298S27644
3 Detroit Diesel V-band clamp
4 Detroit Diesel turbocharger flange
5 5″ OD x 4″ ID Reducer
6 4″ Sealclamp®
7 4″ OD x 16 gage M.S. tube
8 4″ OD x 4-1/2″ R 90° SR elbow
9 4″ Servicemaster® joint
10 Donaldson 10″ x 15″ muffler
11 Muffler mounting plate
12 Mounting adapter
13 Muffler hanger
14 5″ Sealclamp®
15 5″ OD x 16 gage M.S. tube
16 5″ OD x 5-1/2″ R 90° elbow
17 5″ Servicemaster® joint
18 4″ ID S/S flex tube
19 4″ OD x 6″ R 45° elbow
20 3/16″ M.S. tab

The new muffler's body acts as a partial barrier to engine compartment noise emitting through the radiator opening. To compensate for its interference with access to the front of the engine, the muffler is bottom-mounted and jointed with v-band clamps to facilitate quick removal. The oil filler neck is re-worked to give the new muffler clearance.

OIL FILTERS. ETC.

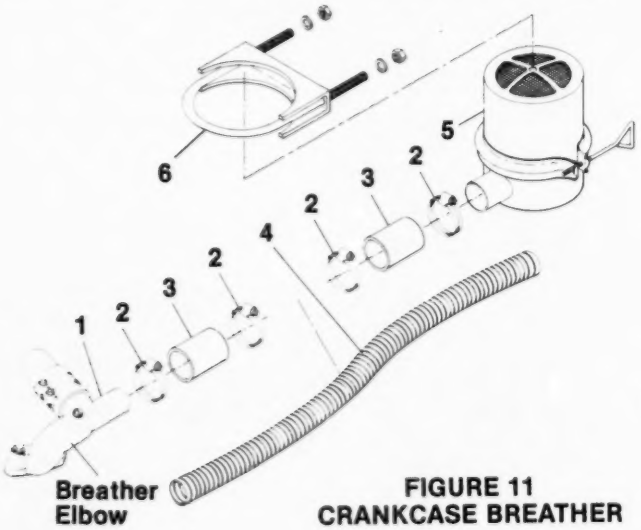
Originally, the exhaust manifolds emptied at the front of the engine into tubes that joined in a wye and led away to the muffler. After turbocharging, the exhaust manifolds empty toward the rear of the engine into tubes that sweep upward into a wye before entering the turbocharger. The left bank tube displaces the primary and secondary fuel oil filters bracketed above and behind the engine to its left.

Since there is no real need for the by-pass lubrication oil filter, it is removed. The space it occupied on the right side of the engine compartment where it was bracketed to the engine cradle hanger is now used for the fuel filters. Their new bracket, SK-B-10041, appears in its relative location in Figure 9. A new run of six hydraulic hoses plumbing the fuel filters must be cut to length and installed using #8 size for supply and #5 for return in accordance with SK-B-10042.

The new air intake system displaces a number of engine compartment accessories. The remote control engine-start switch box is relocated downward by 3½". The small manifold that carries several oil pressure sending units, etc., is moved downward on the firewall, as is the pressure switch that prevents the air conditioner compressor's drive from engaging at engine speeds above low idle.

The radiator surge tank is shifted to the right by 6" and its filler neck is reworked by adding a 5" section to fill the gap. To relieve interference at the rear seat pan, the whole engine cradle is dropped 1/2" at the hangers by means of new clips, SK-B-10029 shown in their relative location in Figure 9.

Due to interference with the rear seat pan, the crankcase breather is relocated from the right hand valve cover to a remote location on the right side cradle hanger, as depicted in Figure 11. The connecting line is teed into the left head cast aluminum breathing system elbow by welding on a short connector.



LEGEND

1 Field-welded 1-1/4" OD x 1" aluminum connector
2 1-1/2" Hose clamp
3 1-1/4" x 2" Heater hose
4 1" ID S/S Flex tube
5 Breather can
6 4" U-bolt clamp

REFER TO DWG: SKI-B-10040

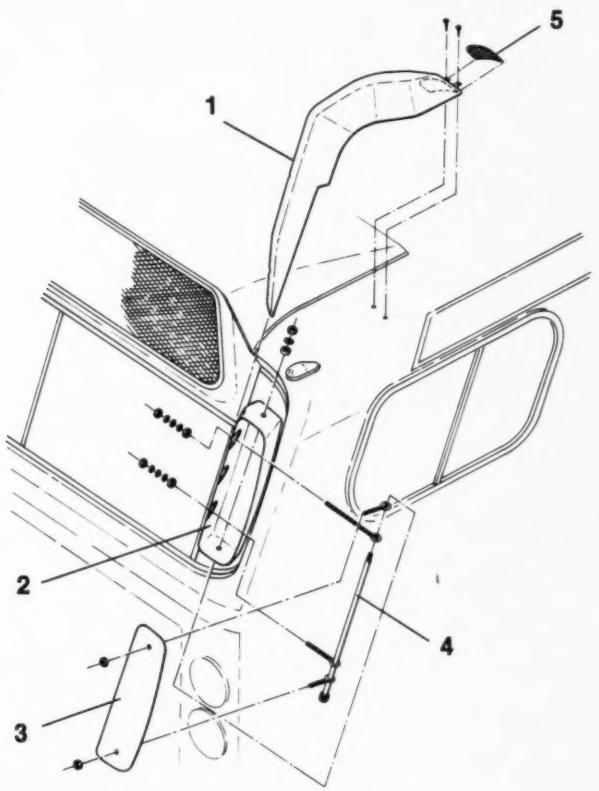
FIGURE 11
CRANKCASE BREATHER

AIR INTAKE SNORKLE

To compensate for the tendency toward shorter air filter service interval caused by the more demanding engine, the loss of the pre-cleaner, and 25% less filter paper area, the air is taken in from a cleaner source atop the bus roof facing forward.

The air intake snorkle is installed in accordance with Figure 12. The OEM plastic intake cowl is removed and its inlet screen discarded. Three 4½" diameter holes 7½" apart are cut along a line centered on the cowl backside. One-inch diameter holes are cut through the top and bottom of the cowl for mounting the snorkle kit through-tube. Eye-bolts braced by the through-tube assemble the snorkle body and inlet blank to the cowl. Two screws hold the leading edge of the snorkle to the bus roof. The cowl is remounted with the original interlocking rubber trim.

LEGEND
1 Snorkle
2 Intake cowl
3 Cowl blank
4 Through-tube assembly
5 Inlet screen



REFER TO DWGS: SKI-B-10046
SKA-B-10052

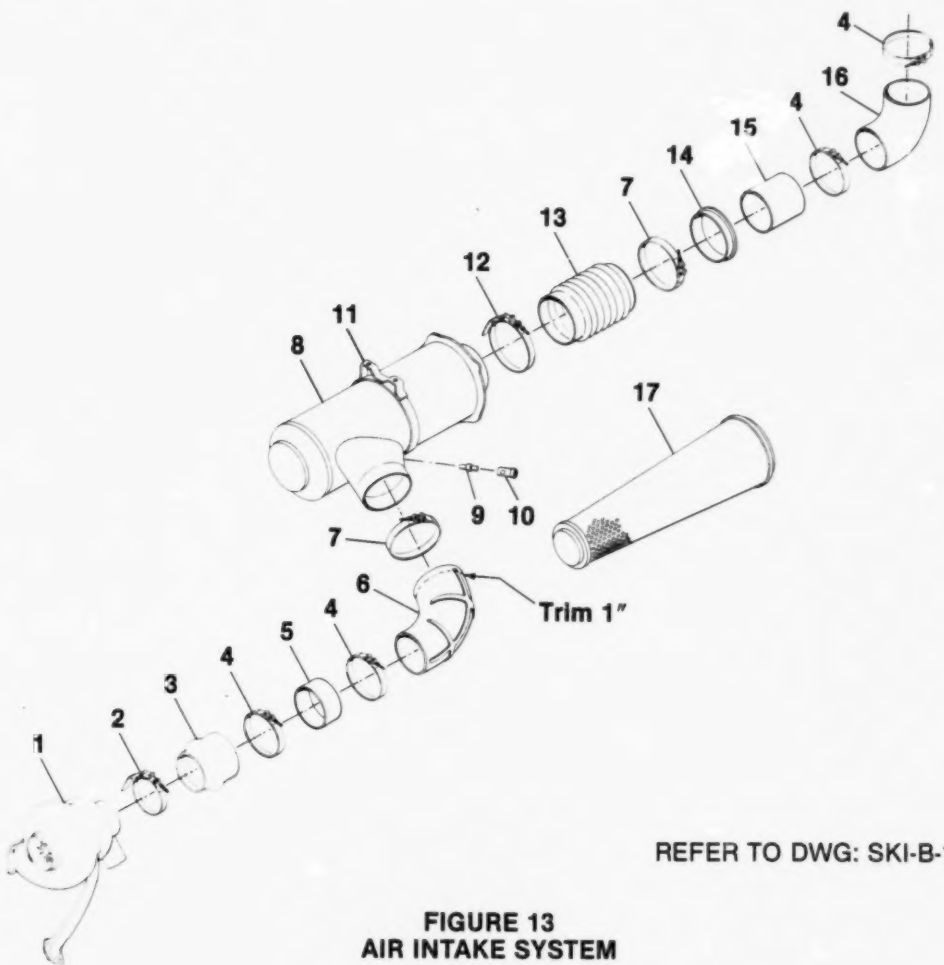
FIGURE 12
HOLLOWAY SNORKLE KIT

AIR INTAKE SYSTEM

A new air intake system is installed because the turbocharger displaces the original air cleaner and because the engine both draws in more air and is more sensitive to air intake restriction (Table 3). The main changes are:

	Before	After
Air cleaner	Donaldson EBA 13-0024	Donaldson EBA 09-2001
Pre-cleaner	Donaldson PVH 000885	Removed
Inlet	Rear window cowl	Rooftop snorkle

The existing air intake system is removed, including the pre-cleaner, all interior screens, and the 45° adapter box. It is replaced with the system shown in Figure 13 which features a smaller, but more compact, state-of-the-art air cleaner.



REFER TO DWG: SKI-B-10044

FIGURE 13
AIR INTAKE SYSTEM

LEGEND FOR FIGURE 13

1 TV-7101 Turbocharger
2 5-1/2" Latch-type band clamp
3 5" Hump hose
4 5-1/2" Band clamp, qty 3
5 5" OD x 3" Aluminum elbow
6 6-to-5 Reducing elbow
7 6-1/2" Band clamp, qty 2
8 Air cleaner
9 Safety filter
10 Restriction indicator
11 Mounting band
12 6-1/2" Latch-type band clamp
13 6-to-5-1/2 Flexible connector
14 5-1/2-to-5 Reducer insert
15 5" OD x 6" Aluminum tube
16 45° Elbow, 5" ID
*17 Replacement element (Included in air cleaner)

COOLING SYSTEM

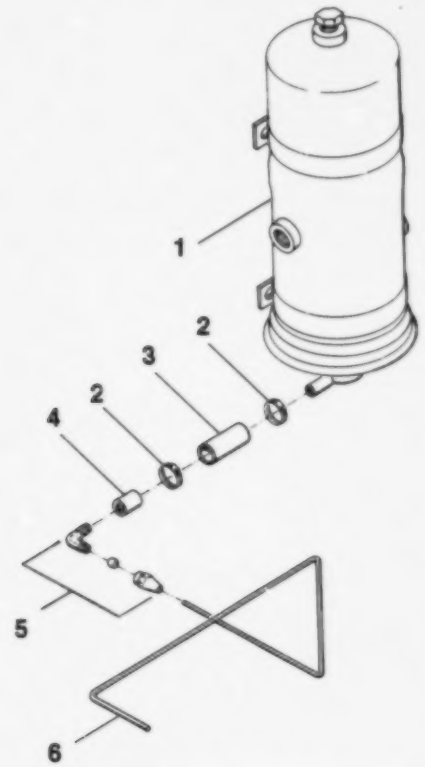
The turbocharger removes heat from the exhaust gas, and the aftercooler removes heat from compressed incoming air. Most of this removed heat is transferred to the engine's cooling system. The cooling load is increased 11%. To offset this extra load, the radiator grille could be rebuilt, giving a larger net area. Potentially, the air-to-boil rating can be improved by 5°F in this way. However, the cooling system already has a surplus capacity to prevent overheating of the engine in any environmental condition, provided it is kept in reasonably good working order. The relatively small added heat load on the cooling system is easily absorbed by this excess capacity. The air-to-boil rating is reduced only 2°F. Therefore, rather than rebuild the grille or take the next step, which would be to replace the existing 4-tube row radiator core with a 5-row core, it is better to pay attention to routine service items such as:

1. Steamclean air side of radiator and keep clean.
2. Do not discard any part of the fan shroud.
3. Keep fan centered in shroud.
4. Keep fan drive thermostat valve working.

AIR DRYER HISS

The air dryer is a safety device, yet it sounds dangerous. Located just downstream from the compressor, it removes condensate from the newly compressed air before the air reaches the valves, chambers, and reservoirs of the air brake system where freezing might cause blockage. Each time the compressor replenishes the air storage tanks, the same signal that unloads the compressor opens the dryer's sump valve, allowing the pent up air within to blow the collected condensate down onto the street below. This causes a loud, prolonged hissing noise. Often this will occur about a half-block after the bus pulls away from a boarding station. Since it sounds like something dramatic is happening with the airbrakes, it scares people, creating an unnecessary sense of alarm and annoyance.

Figure 13 shows a harmless way to silence the air dryer. Simply run a line from the sump to the air conditioning compressor compartment where it will empty into the engine compartment through the hole in the firewall provided for the compressor driveline. Since the dryer's discharge is prolonged, the hissing sound level is lowered to the point where it is masked by the sound in the engine compartment and no longer heard.



LEGEND

1 Bendix air dryer
2 1-1/2" Hose clamp
3 3/4" x 2-1/2" Heater hose
4 3/8" NPT Coupling
5 3/8" Compression elbow
6 3/8" OD x 14' Copper tube

REFER TO DWG: SKI-B-10008B

FIGURE 14
AIR DRYER SILENCING

ESTIMATED COST

It is estimated that the cost of applying the treatment is about $11,000 per bus. Most of this amount is associated with exchanging the engines. In making this estimate, itemized in Table 4, it is assumed that:

Only one or a few buses will be treated at a time.
Workmen are unrehearsed, but supervised and well motivated.
No special tooling is built up.
Common tools, parts, materials, and outside fabricators are available.
Prices are at the 1981 level.
Shop labor and overhead rate is $20 per man-hour.
Purchases are below levels deserving quantity discounts.

In the interest of economy, the treatment is done when the engine is due for overhaul. The net cost of the treatment over the cost of overhauling an 8V-71N is used.

TABLE 4.

COST ESTIMATE

COSTS

	Purchased Parts	Fabrication Labor	Installation Labor	Total
Exchange engines	$12,257	-	$180	$12,437
Anti-noise padding	625	350	260	1,235
Air intake system	315	-	60	375
Engine plumbing, etc.	78	80	90	248
Air intake snorkle	1,000	-	40	1,040
Exhaust system	599	170	60	829
Air dryer line	15	-	40	55
Gross Cost	$14,889	$600	$730	$16,219
Less cost to overhaul 8V-71N				5,025
Net cost of treatment				* $11,194

SHOP LABOR

	Fabrication	Installation	Total Hours
Exchange engines	-	9	9
Anti-noise padding	17½	13	30½
Air intake system	-	3	3
Engine plumbing, etc.	4	4½	8½
Air intake snorkle	-	2	2
Exhaust system	8½	3	11½
Air dryer line	-	2	2
Total man-hours	30	36½	66½

*If the original engine could be saved instead of used as core credit, it might be overhauled and given a turbocharge conversion. The estimated net cost of treatment would then be reduced by $4,719 to $6,475.

ACOUSTICS

Sound is vibration in air... pressure waves. Noise is unwanted sound.

The human ear is an extremely sensitive and delicate organ. A child can detect a sound whose air pressure is only one two-ten thousandths of a millionth of an atmosphere. The ear can momentarily function even when exposed to sound pressure 10 million times this threshold.

Sound is measured with a sound level meter and is usually expressed in terms of A-weighted decibels. The sound level meter consists of a microphone, an amplifying electronic network, and a readout. Too many digits would be involved if sound were expressed in plain pressure units, so decibels are used to make the numbers simpler. A decibel is 20 times the logarithm (power of ten) of the ratio of the measured sound pressure to a reference sound pressure. The reference is the threshold of human hearing. A sound having a thousand times the pressure of the human threshold would have a decibel rating of 60 dB. A-weighting means that the signal is sent through a filter that downgrades low frequency sound corresponding to the response of the human ear.

One does not use simple arithmetic with decibels. For example, 80 dBA plus 80 dBA does not equal 160 dBA. Every time sound pressure doubles, the sound level increases by 3 dBA. 80 + 80 = 83 dBA.

If one sound is 10 dBA louder than another, the lesser is masked out. That is, the sound level of the two together is not detectably more than the greater sound. When a particular noise source is 10 dBA less than the overall noise, then it is unimportant.

Distance has a predictable effect on sound level. Each time one doubles the distance to a sound source radiating from a point in an echo-free space above a reflecting plane, the sound level drops by 6 dBA.

Juries won't agree that there is a difference in level when sounds less than 3 dBA are compared. A sound 10 dBA less than another seems half as loud.

When trying to stop noise by putting a box around the source, one should keep these things in mind:

1. A lot of noise comes through a small hole. An air leak is usally a noise leak too.
2. Kill "live" panels (they ping when you strike them) by stiffening them or by gluing something heavy to them.
3. The walls of the box have to be relatively heavy. Usually a pound or two per square foot is enough for an engine enclosure.
4. Some kind of sound absorptive lining inside of the box is good because it reduces echoes inside. If it becomes less noisy inside the box, it will become less noisy outside the box too.
5. If you can't put a complete box around the source, at least try to put barriers to cut off line-of-sight noise. That is better than leaving open holes.

A bus is a chorus of individual noises. These can be grouped as engine compartment noise, fan noise, exhaust outlet noise, muffler and exhaust pipe shell noise, and tire and body noise.

Engine noise is both sensitive to speed and power. It has a harsh, unpleasant quality. It is the most difficult noise source to treat and is therefore usually the dominant source after the overall bus has been treated. It can be helped by the engine manufacturer through smoothing of the onset of combustion, by stiffening the block, and by curing "hot spots". This takes a long time and is expensive. Other treatments are turbocharging and encapsulation. The simplest treatment is to reduce speed and power output.

The fan makes a whirring sound, coming from where the blade tips chop the air. It is steeply sensitive to fan speed, so a modulating speed drive is better for noise control than an on-off drive. At least sometimes you will hear the fan if it has an on-off drive, but you might never be bothered by fan noise with a modulating speed drive. Nothing much can be done to cure fan noise except to slow the fan down. This is more easily done at the factory through the use of larger radiators than in the field.

Exhaust outlet noise is more mellow and musical. Most uninitiated believe they are hearing exhaust noise and blame the muffler when a loud bus goes by. It might well be a break in the exhaust piping upstream of the muffler, or more often just plain engine noise they are hearing. Exhaust noise is relatively easy to treat. All one needs is a proper muffler. With turbocharged engines, there is a need for low back pressure. This leads to the problem of finding room for the adequate muffler. To have low back pressure *and* good silencing, a muffler can't be kept small.

Muffler and exhaust pipe shell noises might be revealed as treatment of the louder engine, exhaust, and fan noises progresses. Common practice is to double the skin of the muffler body when used with naturally aspirated engines. The need is less with turbocharged engines. Pipe shell noise does not ordinarily require treatment, but there might be significant noise radiating from flexible tube sections. At times, significant noise can escape pipe joints when old style u-bolt-and-saddle clamps are used. Modern stretchable overlapping band clamps solve this problem.

Tire noise is unimportant at speeds below 40 mph for the ordinary bus. Even after treatment, tire noise is masked out at speeds below 30 mph. Body noise can be a nuisance if there are loose doors and windows.

Noise radiates in all directions from a bus of the type we treat here, but not evenly. Less noise radiates forward because the bus body is a barrier to engine noise in the rear. The bus is noisier on the left side than on the right, not because the exhaust stack is on that side, but because the radiator opening is there... an open door to noise from the engine compartment. Fortunately, the boarding passengers are exposed to right side noise which is quieter and easier to treat than left side noise.

Inside the bus, no one needs to be told that it is louder in the rear than up front. The source of noise heard is almost always the engine... not the exhaust and not the fan. The structureborne path is at least as great as the airborne path. It is important to keep the rear seat engine compartment access hatch well fitted and sealed tight, and to replace worn-out engine mounts.

We believe the operator of a city transit bus should judge a treatment by its effect on the ordinary noise a bus makes most of the time; not on the maximum noise it makes only once in awhile. A treatment that reduces the one does not necessarily reduce the other. Consequently, we believe it is better to evaluate the bus with its fan drive in the "as-is" condition and not artificially locked up. We use the following criteria:

Exterior Noise.

Average of right side and left side peak sound level during a 50-foot full acceleration pass-by through first upshift.

Interior Noise.

Average of rear seat and driver's seat peak sound level during full acceleration through first upshift.

By these criteria, the results of treating a bus in accordance with this Retrofit Instruction are:

	As-Is Average Exterior Rating*	As-Is Average Interior Rating*
Baseline (Typical Tri-Met)	79 dBA	75½ dBA
After Treatment	75½ dBA	72½ dBA
Reduction	3½ dBA	3 dBA

*Rounded to the nearest ½ dBA

An acoustically effective bellypan would make possible a further reduction to the average exterior rating of at least 3 dBA, but this has not been reduced to practical hardware.

A more detailed breakdown by side and source is given in Table 4. This enables comparison with other standards such as the U.S. EPA proposed rule for regulating manufacturers of buses. The EPA rule is "worst-case" oriented. It considers only the "fan-on" condition and the louder side or end. The proposed levels are:

	Exterior	Interior
First year	83 dBA	86 dBA
Fifth year	80 dBA	83 dBA
Seventh year	77 dBA	80 dBA

TABLE 5.

NOISE SOURCE DIAGNOSIS BEFORE AND AFTER TREATMENT
Measured by EPA 50-foot Acceleration Pass-by Test

(Rounded to Nearest ½ dBA)

BASELINE

EXTERIOR		LEFT	RIGHT
SOURCE	ENGINE	78	73½
	SHELL	72	65
	EXHAUST	71	67
	TIRES	58	58
	FAN ON	80½	77½
	FAN AS-IS	77½	73
OVERALL	FAN ON	*83½	79½
	FAN AS-IS	82	77
	FAN OFF	80	75
INTERIOR		REAR	FRONT
	FAN ON	*79	72½
	FAN AS-IS	78	72½

TREATED

EXTERIOR		LEFT	RIGHT
SOURCE	ENGINE	77	72
	SHELL	NIL	NIL
	EXHAUST	63½	59½
	TIRES	58	58
	FAN ON	77	74½
	FAN AS-IS	70	62½
OVERALL	FAN ON	*80	76½
	FAN AS-IS	78	73
	FAN OFF	77	72½
INTERIOR		REAR	FRONT
	FAN ON	*76	69
	FAN AS-IS	75½	69

*Comparable to EPA Rating

EFFECTS ON PERFORMANCE

Table 5 quantifies the side-effects of the noise control treatment on various aspects of bus performance. It complements the data presented in Table 3. In general, emissions and aspiration are improved, delivered power and fuel economy are unchanged or slightly improved, cooling system capacity is affordably decreased. Predicted aggregate maintenance costs are not measurably changed.

TABLE 6.

PERFORMANCE BENCHMARKS BEFORE AND AFTER TREATMENT

(#1 Diesel Fuel)

	UNITS	BASELINE	TREATED
POWER OUTPUT			
Terminal Speed on 4% Grade	mph	44	48½
Acceleration on Flat [1]200-foot Time	sec	8.7	9.2
[2]Engine Dynamometer Full throttle, 2,000 rpm	BHP	218	
FUEL MILEAGE			
Average Mission	mpg	[3]4.16	[4]4.26
COOLING SYSTEM			
[5]ATB on 4% Grade	°F	132	130
Fan Delivery, 1,500 rpm	CFM	9,600	9,600
ASPIRATION (Full Power, 2,000 rpm)			
Exhaust Back Pressure	"Hg	6.2	3.5
Exhaust Temperature	°F	895	600
Intake Restriction	"H_2O	12	15

[1] Full throttle from a standing start.
[2] Data supplied by engine manufacturer.
[3] 4-year fleet average.
[4] 10½ months in-service average.
[5] The ambient air temperature at which the coolant would theoretically warm up to the boiling point of water, 212°.

ABBREVIATIONS

A/C	Air Conditioning
AGE	Aluminized Glass Edging Tape
AL, ALUM	Aluminum
ATB	Air-to-Boil Temperature
µbar	One-millionth of an atmosphere of pressure
B.C.	Bolt Circle
BHP	Brake Horsepower
BMEP	Brake Mean Effective Pressure
BSFC	Brake Specific Fuel Consumption
BTU	British Thermal Unit
CFM	Cubic Feet per Minute
CO	Carbon Monoxide
dBA	A-weighted decibel referenced to .0002 µbar
DIA, dia	Diameter
DWG	Drawing
EIP	Environmental Improvement Package
°F	Degree Fahrenheit
Flex	Flexible
ft^2	Square Foot
GA	Gage
GPM	Gallons per Minute
HC	Hydrocarbons
"Hg	Inches of Mercury
"H_2O	Inches of Water
hr	Hour
ID	Inside Diameter
in^2	Square Inches
INST.	Installation
L.B.	Left Bank
lbs	Pounds
min	Minute
mm	Millimeter
mpg	Miles per Gallon
mph	Miles per Hour
M.S.	Mild Steel
MTG	Mounting
NC	National Coarse Thread
NO_2	Nitrous Oxide
NPT	National Pipe Thread
OD	Outside Diameter
oz	Ounce
PPM	Parts per Million
psi	Pounds per Square Inch
R, RAD	Radius
REF	Reference
R.B.	Right Bank
rpm	Revolutions per Minute
sec	Second
S.S.	Stainless Steel
TYP	Typical

APPENDIX A.

PURCHASE LIST

This list is not an endorsement.
There are interchangeable or equivalent products.

Note: Common fasteners not called out.

Quantity	Brand or Manufacturer	Size or Part Number	Description	Where Used
3	Aeroquip	55083-550-2	5½" Band Clamp	SKI-B-1044
2	Aeroquip	55083-650-2	6½" Band Clamp	SKI-B-1044
1	Aeroquip	MB9360-S-075-N-550	5½" Latch Band Clamp	SKI-B-1044
1	Aeroquip	MB9360-S-075-N-650	6½" Latch Band Clamp	SKI-B-1044
1	Aeroquip	MLJ 8750-500S	5" Servicemaster	SKA-B-10038
1	Aeroquip	MLJ 8750-400S	4" Servicemaster	SKA-B-10037
1	Bostitch	P50-5B	Pneumatic Stapler	IC Pads
1 Box	Bostitch	SB-5019-5/8"	S.S. Staples	IC Pads
40"x88"	Carborundum	Grade FW35	Flexweave 1000 Cloth	SKA-B-10003B SKA-B-10030
1	Detroit Diesel	5110384	Breather	SKI-B-10040
1	Detroit Diesel	5101814	Turbocharger Flange	SKA-B-10037
1	Detroit Diesel	5132650	V-Band Clamp	SKA-B-10037
1	Donaldson	21010	4" OD 90° Elbow	SKA-B-10037
1	Donaldson	17061	5" Sealclamp	SKI-B-10045
4	Donaldson	17060	4" Sealclamp	SKI-B-10045
1	Donaldson	5080B79	MOM 12-0083, Modified	SKI-B-10045
2	Donaldson	21067	4-5 ID-OD Reducer	SKA-B-10037 SKA-B-10038
2	Donaldson	21016	5" OD 90° Elbow	SKA-B-10038
1	Donaldson	P10-0089	Safety Filter	SKI-B-10044
1	Donaldson	RBX00-2278	Restriction Indicator	SKI-B-10044
1	Donaldson	ECG11-2000	Air Cleaner	SKI-B-10044
1	Donaldson	P00-4079	Mounting Band	SKI-B-10044
1	Donaldson	17010	4" Guillotine Clamp	SKI-B-10040
24" long	Federal	4"-R200S	4" ID S.S. Flex Tube	SKA-B-10038
23" long	Federal	1"-R200S	1" ID S.S. Flex Tube	SKI-B-10040
1	HITCO	298S27644	Turbo-Charger Blkt.	SKI-B-10045
1	Holloway	SKA-B-10052	Snorkle Kit	SKI-B-10046
1	Huntington	90HL60R50SR	6-to-5 90° Reducing Elbow	SKI-B-10044
1	Huntington	60R55FLEX1100	6-to-5½ Reducing Flex	SKI-B-10044
1	Huntington	45HL5	5" x 45° Elbow	SKI-B-10044
1	Huntington	3H5	5" Hump Hose	SKI-B-10044
1	Huntington	99555	5½-to-5 Reducer Insert	SKI-B-10044
1½ 25' rolls	Insul-Coustic	Type 6, 10 oz/ft^2	48" Wide Insul-Quilt	IC Pads
100 yards	Insul-Coustic	3" Wide	AGE Tape	IC Pads
15" x 48"	Local Supply	3/16" Thick	M.S. Plate	SK-B-10000A SKA-B-10001B SKA-B-10038 SKA-B-10041 SK-B-10043
2" x 28"	Local Supply	1/4" Thick	M.S. Plate	SK-B-10029
15" x 20"	Local Supply	14 gage	Alum Sheet	SK-B-10034
14'	Local Supply	SAE J844B, Type 1	3/8" OD Copper Tube	SKI-B-10008B
4"	Local Supply	SAE 20R2-2	1¼" ID Collant Hose	SKI-B-10040
2½"	Local Supply	SAE 20R2-2	3/4" ID Collant Hose	SKA-B-10008B
5½"	Local Supply	5" OD, 16 gage	M.S. Tube	SKI-B-10038
13"	Local Supply	4" OD, 16 gage	M.S. Tube	SKA-B-10037
1	Local Supply	3/8" NPT	Pipe Coupling	SKI-B-10008B
1	Local Supply	3/8" x 3/8" NPT	Compression Elbow	SKI-B-10008B
2	Local Supply	SAE Type F-16	1½" Hose Clamp	SKI-B-10008B
1	Western Piping	1300-40-01	45° Elbow	SKA-B-10038

APPENDIX A.

SPECIALTY SUPPLIERS

Aeroquip-Marmon Plant
11214 Exposition Blvd.
Los Angeles, CA 90064
(213) 478-0921

Carborundum Co.
Insulation Division
P.O. Box 808
Niagra Falls, N.Y. 14302
(716) 278-6221

Donaldson C., Inc.
1400 W. 94th St.
Minneapolis, Minnesota 55440

Federal Hose Mfg. Corp.
P.O. Box 548
Painesville, Ohio 44077
(216) 352-8927

HITCO Insulation Products
2302 Marietta Blvd. N.W.
Atlanta, Georgia 30318
(404) 355-1205

Holloway Product Development
14023 N.W. Science Park Drive
Portland, Oregon 97229
(503) 643-7338

Huntington Rubber Co.
6800 S.W. Macadam Blvd.
Portland, Oregon 97219
(503) 246-5411

Insul-Coustic
Jernee Mill Road
Sayreville, New Jersey 08872
(201) 257-6674

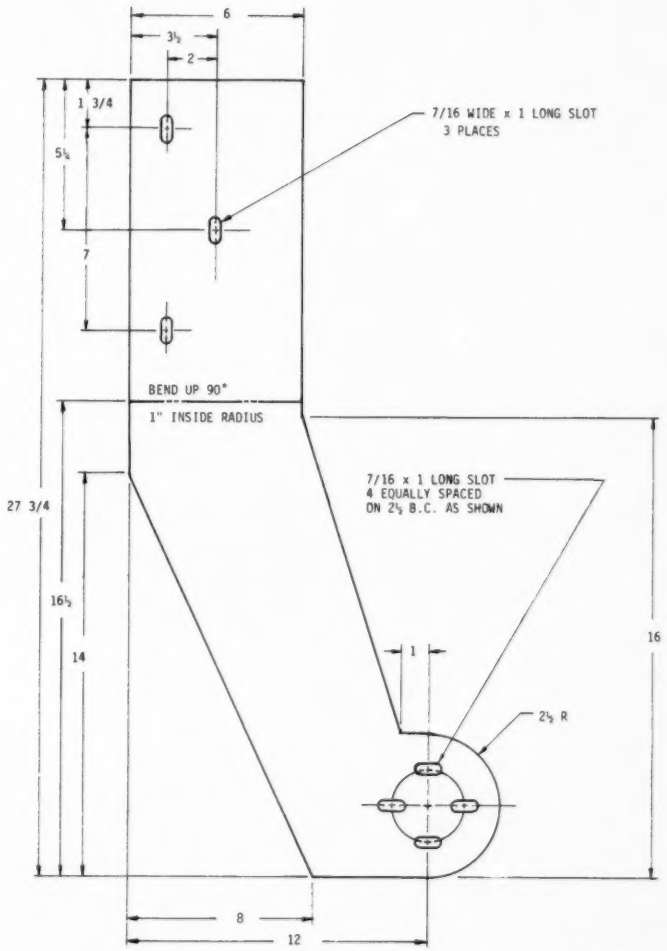
Western Piping & Engineering Co., Inc.
1485 Yosemite Avenue
San Francisco, California 94124
(415) 822-6464

APPENDIX B.

TRI-MET DRAWINGS

Number	Title
SK-B-10000A	MUFFLER HANGER BRACKET
SKA-B-10001B	MUFFLER MOUNTING PLATE ASS'Y
SKA-B-10003B	MUFFLER JACKET ASS'Y
SKI-B-10008B	DRYER AIR LINE INST
SKI-B-10028	RADIATOR PADDING
SK-B-10029	CRADLE HANGER CLIPS
SKA-B-10030	MANIFOLD HEAT PAD
SKI-B-10031	REAR DOOR PADDING INST
SKI-B-10032	A/C COMPARTMENT PADDING
SKI-B-10033	ENGINE COMPARTMENT PADDING INST
SK-B-10034	EXHAUST PASSAGE BLANK
SKA-B-10035	MUFFLER MOUNTING ASSY
SKA-B-10037	MUFFLER INLET ASS'Y
SKA-B-10038	MUFFLER OUTLET ASS'Y
SKI-B-10040	CRANKCASE BREATHER INST
SKA-B-10041	FUEL FILTER BRACKET
SK-B-10042	FUEL SYSTEM SCHEMATIC
SK-B-10043	MUFFLER MOUNTING ADAPTER
SKI-B-10044	AIR INTAKE SYSTEM INST
SKI-B-10045	EXHAUST SYSTEM INST
SKI-B-10046	HOLLOWAY SNORKLE INST
SK-B-10047	ENG COMPT PADS - RIGHT SIDE
SK-B-10048	ENG COMPT PADS - FIREWALL
SK-B-10049	ENG COMPT PADS - SEAT PAN
SK-B-10050	ENG COMPT PADS - OVERHEAD
SK-B-10051	ENG COMPT PADS - LEFT SIDE
SKA-B-10052	HOLLOWAY SNORKLE KIT

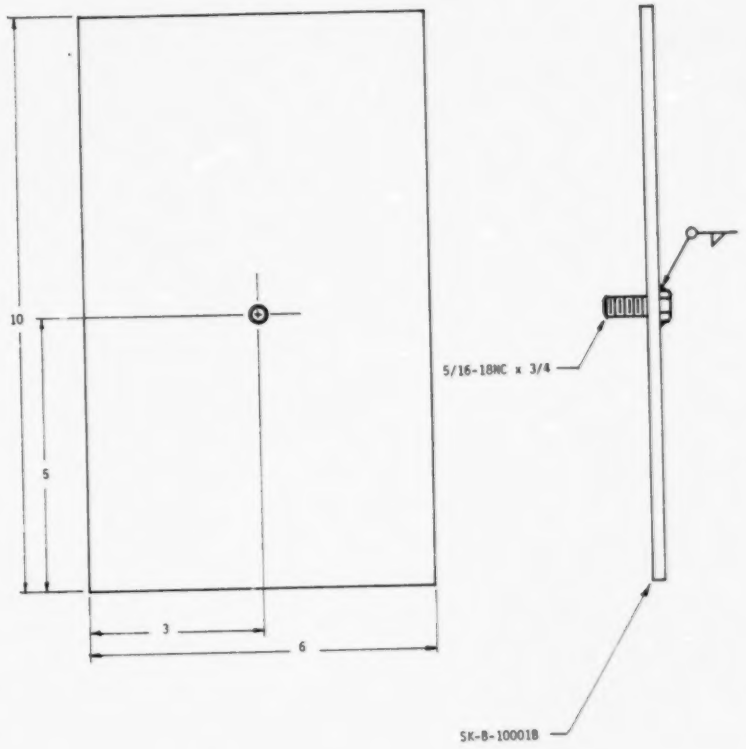
SK-B-10000A



NOTE: PRIME BEFORE INST.

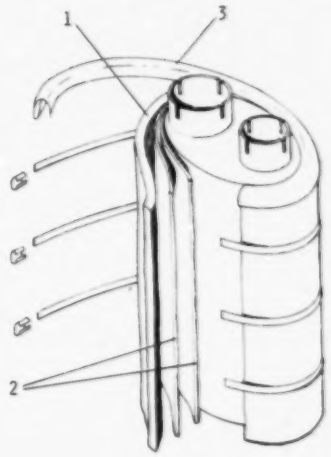
REVISED: 10-30-81 ML		
DATE DRAWN: 12-13-79	MATERIAL: 3/16 M.S. PLATE	TITLE: MUFFLER HANGER BRACKET
DRAWN BY: RJK CHECKED BY: ML	WHERE USED: SKI-C-10026 SKA-B-10035	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10000A

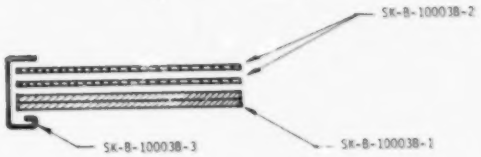
SKA-B-10001B

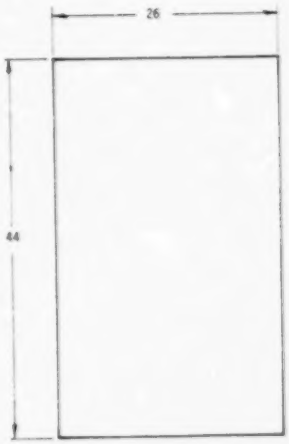


REVISED: 11-1-81 AK		
DATE DRAWN: 12-9-79	MATERIAL: 3/16" M.S. PLATE	TITLE: MUFFLER MTG PLATE ASSY
DRAWN BY: RJK CHECKED BY: AK	WHERE USED: SKI-C-10026 SKA-B-10035	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND OREGON 97202	DRAWING NUMBER: SKA-B-10001B

SKA-B-10003B





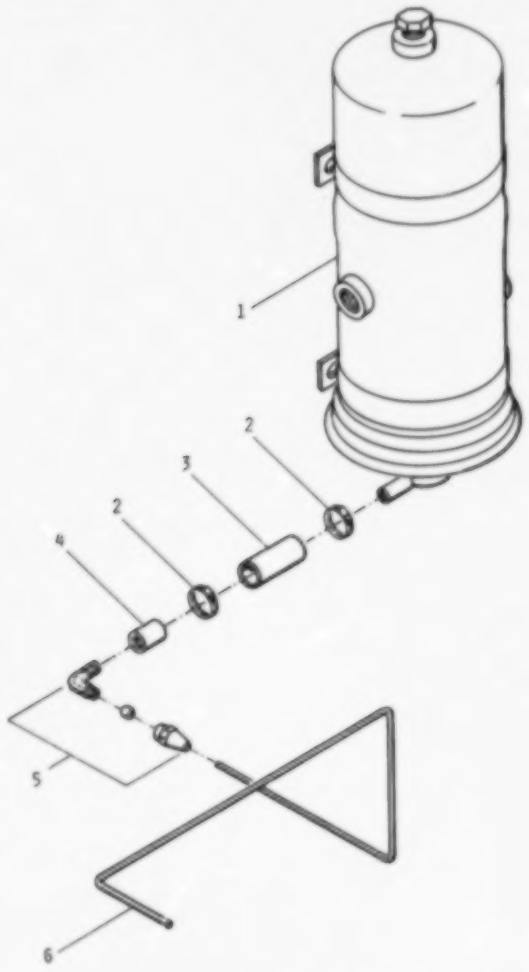


DASH	QTY	MATERIAL
1	1	INSUL-QUILT TYPE 6 - 10 OZ/FT²
2	2	CARBORUNDUM FLEXWEAVE 1000 CLOTH GRADE FW35
3	1	INSUL-COUSTIC AGE TAPE 3" WIDE

REVISED

DATE DRAWN 11-6-81	MATERIAL AS NOTED	TITLE MUFFLER JACKET ASSY
DRAWN BY MK CHECKED BY	WHERE USED 10 X 15 OVAL MUFFLER 26" LONG	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER SKA-B-10003B

SKI-B-10008B

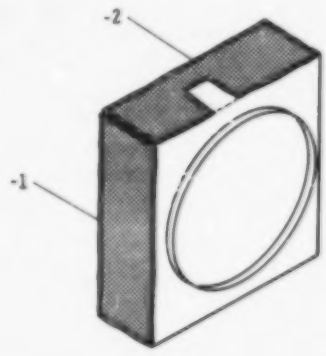


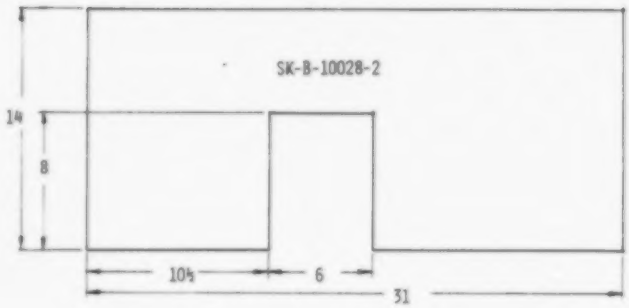
REF	PART NUMBER	DESCRIPTION
1	AD-2	BENDIX AIR DRYER
2	SAE TYPE F-16	1½" HOSE CLAMP
3	SAE 20R3-2	3/4" x 2¼" HEATER HOSE
4	SAE 6-6 130138CA	3/8" NPT COUPLING
5	SAE 6-6 120202BA	3/8" COMPRESSION ELBOW
6	SAE J844B Type 1	3/8" OD x 14' COPPER TUBE

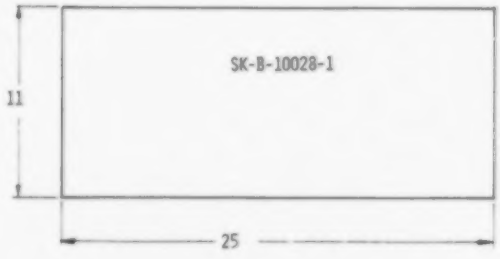
REVISED 10/19/81

DATE DRAWN 1/4/80	MATERIAL AS NOTED	TITLE DRYER AIR LINE INST.
DRAWN BY AG CHECKED BY	MISSING LINES ANY BRAKE SYSTEM AIR DRYER	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .000	TRI-MET 6012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER SKI-B-10008B

SKI-B-10028



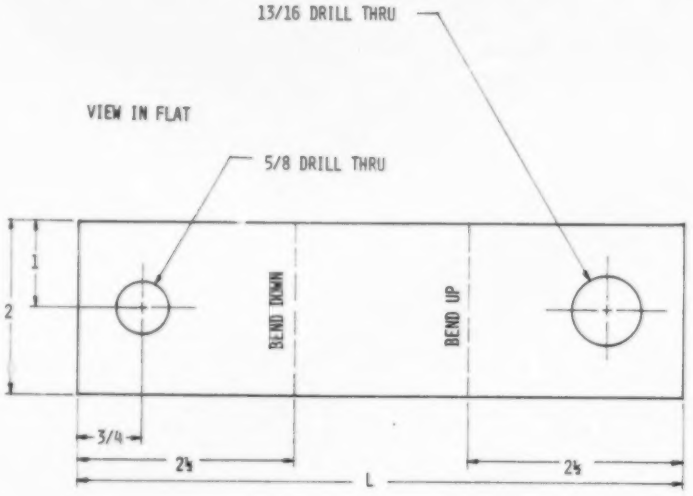


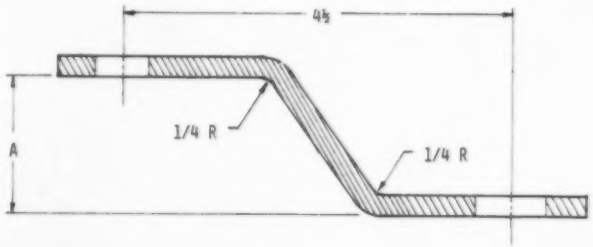


REVISED:

DATE DRAWN: 10/19/81	MATERIAL: INSUL-QUILT TYPE 6, 10 OZ/FT³	TITLE: RADIATOR PADDING
DRAWN BY: MK CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10028

SK-B-10029



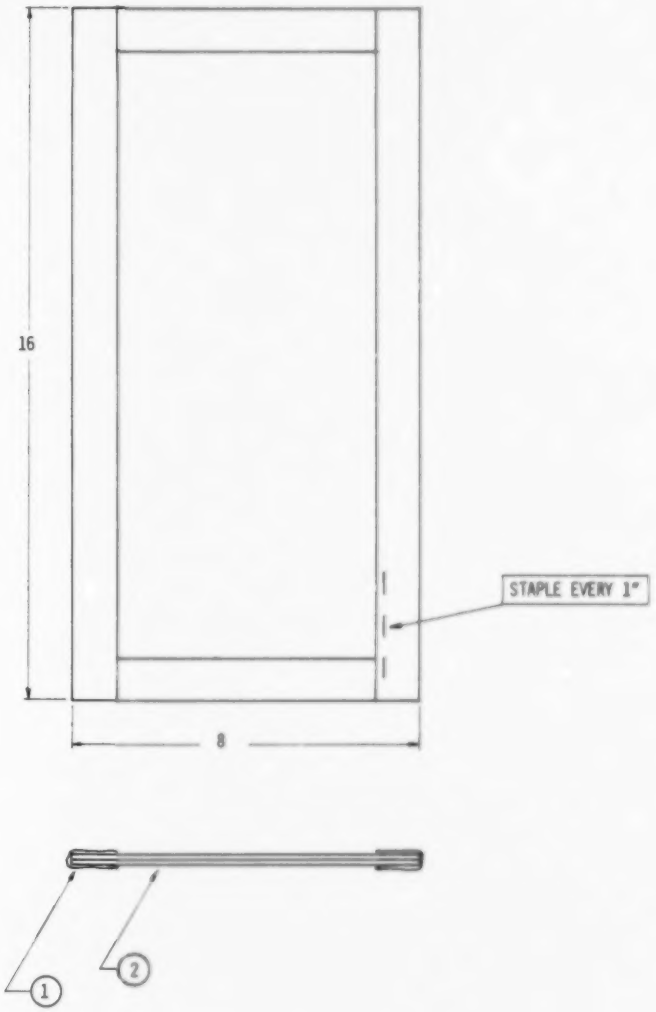


PART NUMBER	A	L
SK-B-10029-1	1 1/8	6½
SK-B-10029-2	1 5/8	7

REVISED

DATE DRAWN: 10-26-81	MATERIAL: 1/4" M.S. PLATE	TITLE: CRADLE HANGER CLIPS
DRAWN BY: CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10029

SKA-B-10030

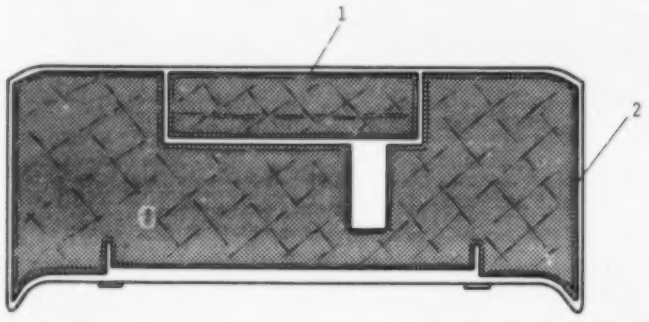


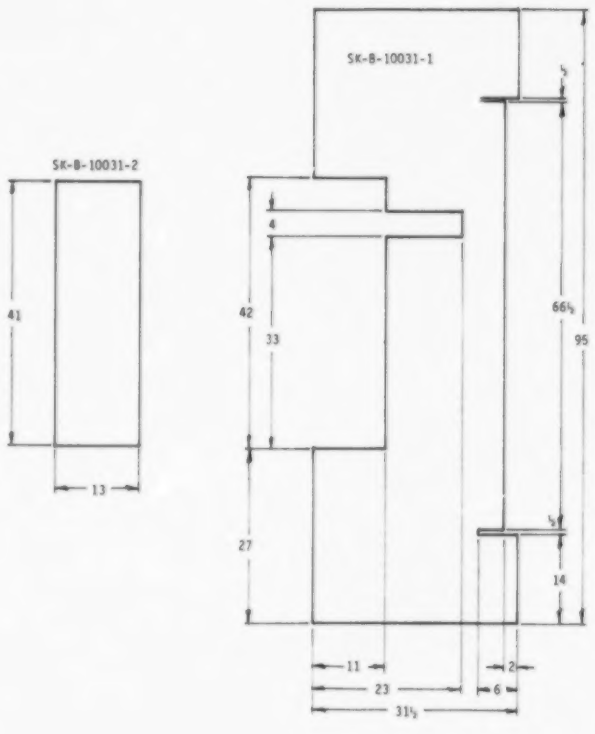
REF	MATERIAL
1	INSUL-COUSTIC 3" WIDE EDGING TAPE
2	CARBORUNDUM FLEXWEAVE 1000 CLOTH GRADE FW35

REVISED:

DATE DRAWN: 10-26-81	MATERIAL: AS NOTED	TITLE: MANIFOLD HEAT PAD
DRAWN BY: MJL CHECKED BY:	WHERE USED: SKI-B-10033	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17th AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKA-B-10030

SKI-B-10031

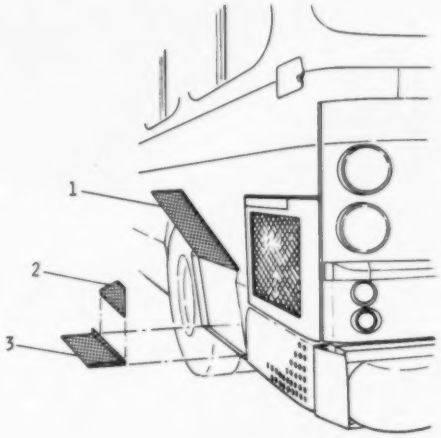


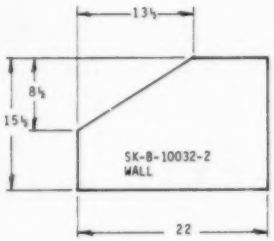


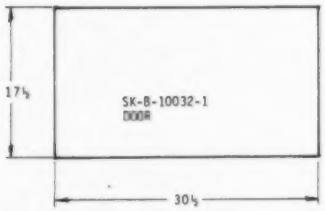
REVISED

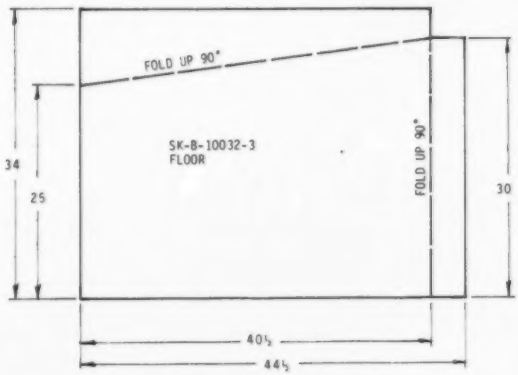
DATE DRAWN: 11-2-81	MATERIAL: INSUL-QUILT TYPE 6, 10 OZ/FT²	TITLE: REAR DOOR PADDING
DRAWN BY: MC CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4912 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10031

SKI-B-10032





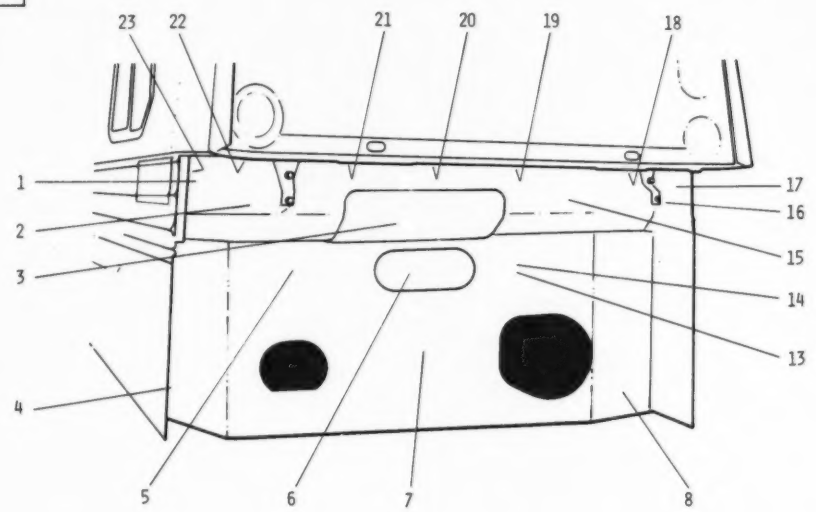


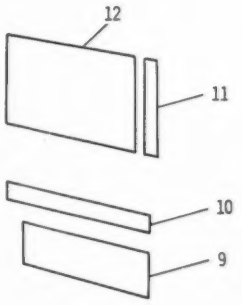


REVISED:

DATE DRAWN: 11-1-81	MATERIAL: INSUL-QUILT TYPE 6 - 10 OZ/FT²	TITLE: A/C COMPARTMENT PADDING
DRAWN BY: MAL CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10032

SKI-B-10033



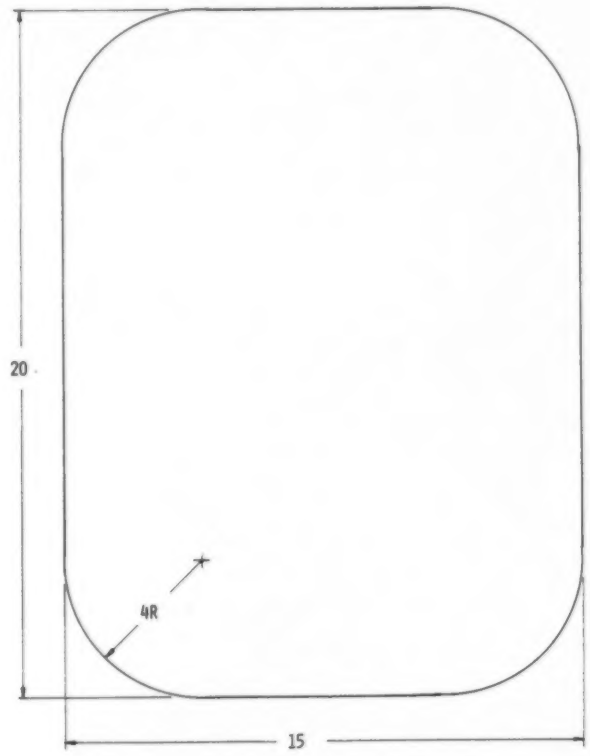


REF	NOMENCLATURE
1	SK-B-10051-2
2	SK-B-10049-2
3	SK-B-10049-4
4	SK-B-10051-1
5	SK-B-10048-1
6	SK-B-10048-2
7	SK-B-10048-5
8	SK-B-10048-4
9	SK-B-10047-4
10	SK-B-10047-3
11	SK-B-10047-2
12	SK-B-10047-1
13	SK-B-10030
14	SK-B-10048-3
15	SK-B-10049-3
16	SK-B-10047-6
17	SK-B-10047-5
18	SK-B-10050-1
19	SK-B-10050-4
20	SK-B-10050-2
21	SK-B-10050-3
22	SK-B-10050-5
23	SK-B-10049-1

REVISED:

DATE DRAWN: 11-2-81	MATERIAL: AS NOTED	TITLE: ENGINE COMPARTMENT PADDING
DRAWN BY: CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10033

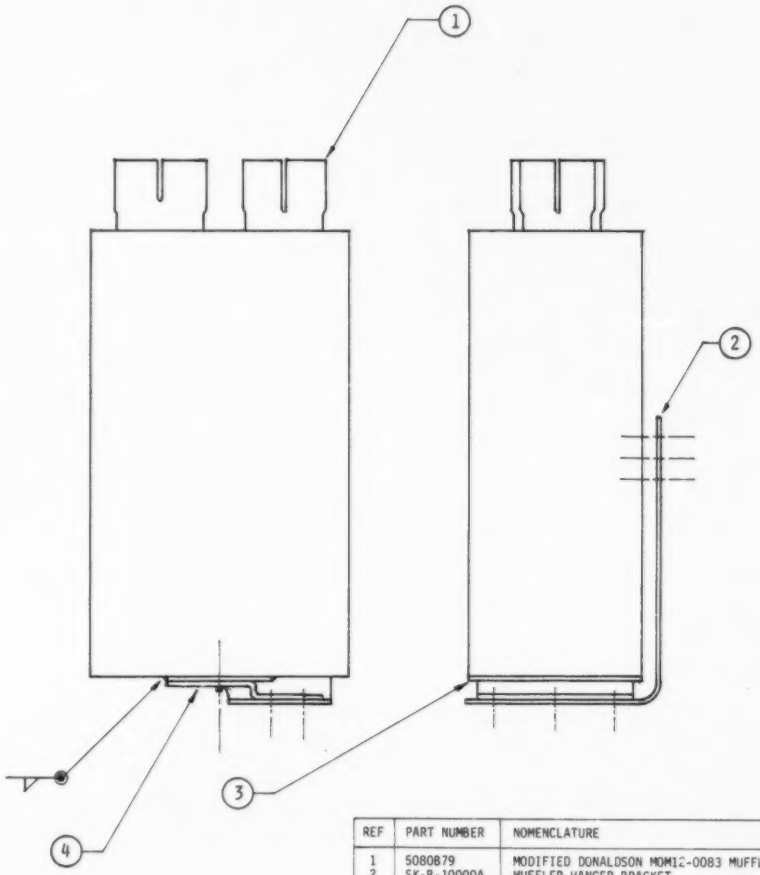
SK-B-10034



REVISED:

DATE DRAWN: 10-26-81	MATERIAL: 14 GAGE ALUM	TITLE: EXHAUST PASSAGE BLANK
DRAWN BY: MK CHECKED BY:	WHERE USED: SKI-B-10033	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10034

SKA-B-10035

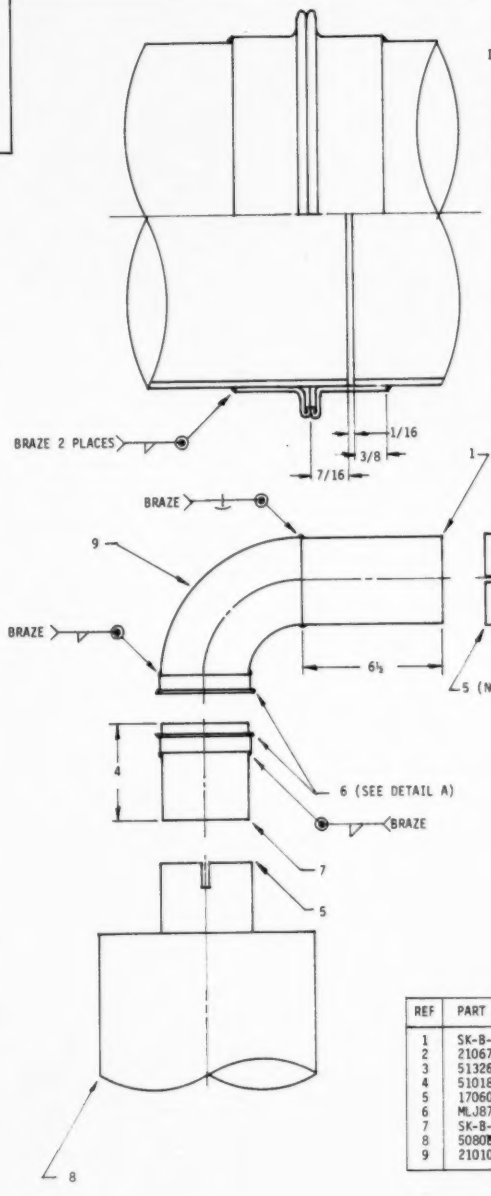


REF	PART NUMBER	NOMENCLATURE
1	5080879	MODIFIED DONALDSON MOMIC-0083 MUFFLER
2	SK-B-10000A	MUFFLER HANGER BRACKET
3	SKA-B-10001B	MUFFLER MOUNTING PLATE ASSY
4	SK-B-10043	MUFFLER MOUNTING ADAPTER

REVISED:

DATE DRAWN: 11-1-81	MATERIAL: AS NOTED	TITLE: MUFFLER MOUNTING ASSY
DRAWN BY: MK CHECKED BY:	WHERE USED: SKI-B-10045	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKA-B-10035

SKA-B-10037



NOTES:

COMPLETE AEROQUIP SERVICEMASTER® JOINTS INCLUDE:

SIZE	4"	5"
JOINT	MLJ8750-400S	MLJ8750-500S
[1]FLANGE	MFF61196-400S	MFF6196-500S
[2]COUPLING	55000-400S	55000-500S

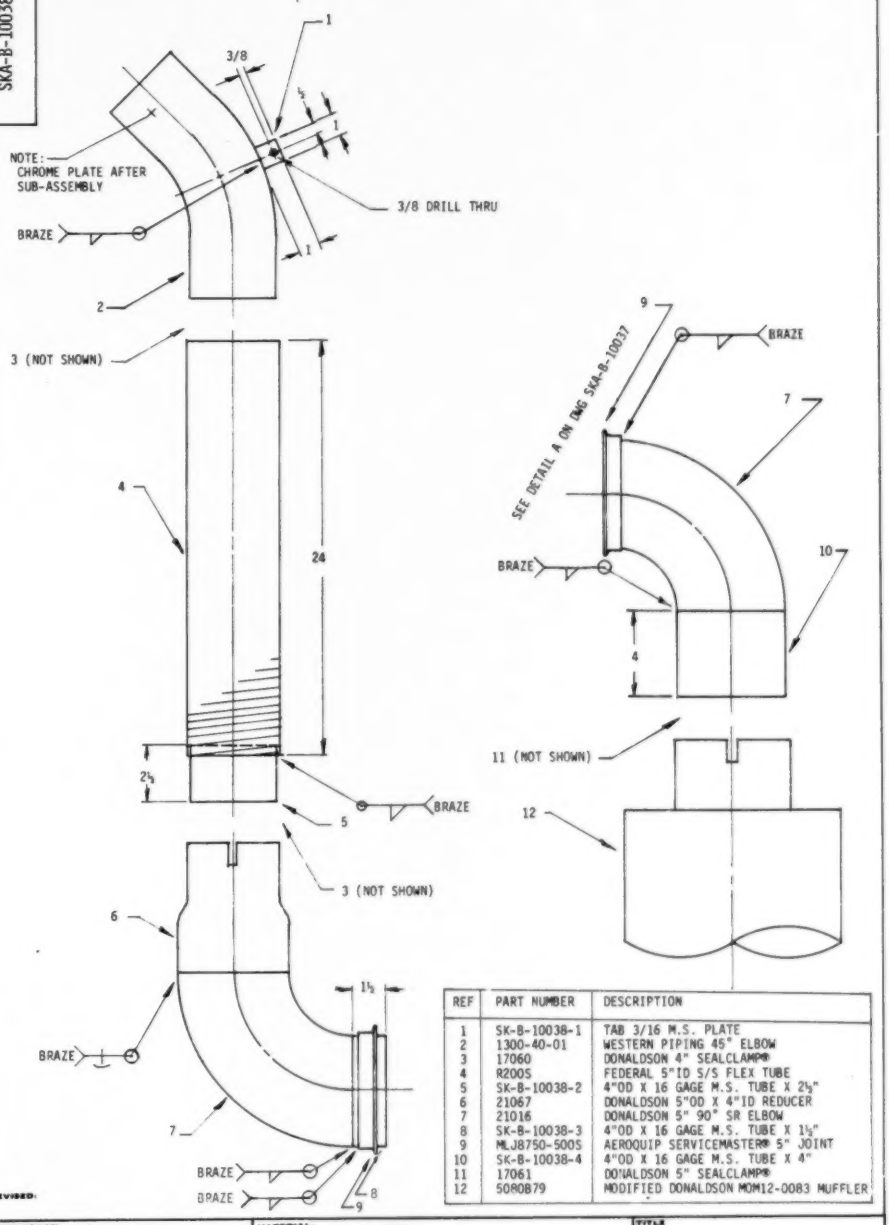
[1] 2 PCS.
[2] 1 PC. (NOT SHOWN)

REF	PART NUMBER	DESCRIPTION
1	SK-B-10037-1	4"OD X 16 GAGE M.S. TUBE X 6½"
2	21067	DONALDSON 5"OD X 4"ID REDUCER
3	5132650	DETROIT DIESEL CLAMP
4	5101814	DETROIT DIESEL FLANGE
5	17060	DONALDSON 4" SEALCLAMP®
6	MLJ8750-400S	AEROQUIP SERVICEMASTER® 4" JOINT
7	SK-B-10037-2	4"OD X 16 GAGE M.S. TUBE X 4"
8	5080879	MODIFIED DONALDSON MDM12-0083 MUFFLER
9	21010	DONALDSON 4" 90° SR ELBOW

REVISED:

DATE DRAWN: 11-6-81	MATERIAL: AS NOTED	TITLE: MUFFLER INLET ASSY
DRAWN BY: CHECKED BY:	WHERE USED: SKI-B-10045	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKA-B-10037

SKA-B-10038

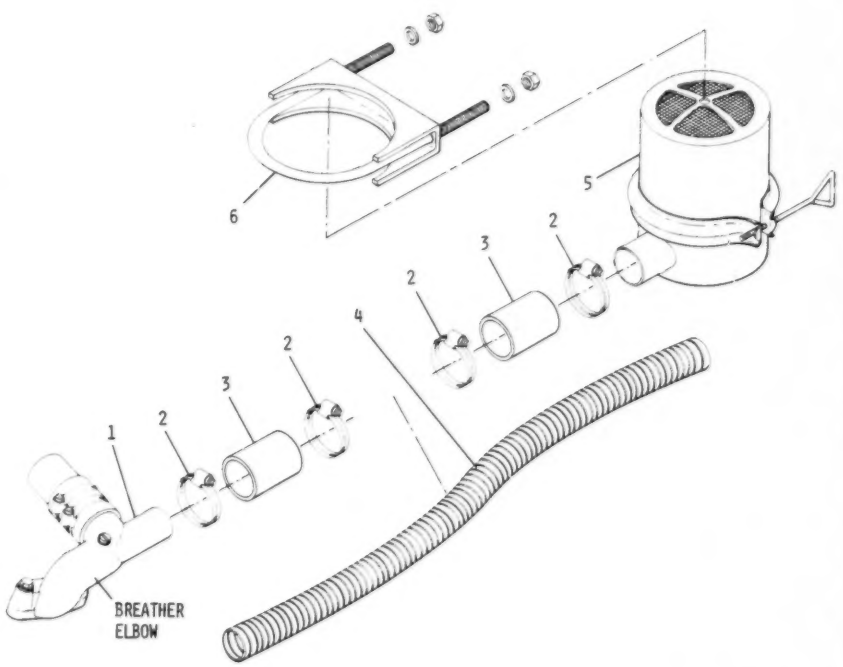


REF	PART NUMBER	DESCRIPTION
1	SK-B-10038-1	TAB 3/16 M.S. PLATE
2	1300-40-01	WESTERN PIPING 45° ELBOW
3	17060	DONALDSON 4" SEALCLAMP®
4	R200S	FEDERAL 5"ID S/S FLEX TUBE
5	SK-B-10038-2	4"OD X 16 GAGE M.S. TUBE X 2½"
6	21067	DONALDSON 5"OD X 4"ID REDUCER
7	21016	DONALDSON 5" 90° SR ELBOW
8	SK-B-10038-3	4"OD X 16 GAGE M.S. TUBE X 1½"
9	MLJ8750-5005	AEROQUIP SERVICEMASTER® 5" JOINT
10	SK-B-10038-4	4"OD X 16 GAGE M.S. TUBE X 4"
11	17061	DONALDSON 5" SEALCLAMP®
12	5080879	MODIFIED DONALDSON MDM12-0083 MUFFLER

REVISED:

DATE DRAWN: 11-7-81	MATERIAL: AS NOTED	TITLE: MUFFLER OUTLET ASSY
DRAWN BY: CHECKED BY:	WHERE USED: SKI-B-10045	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKA-B-10038

SKI-B-10040

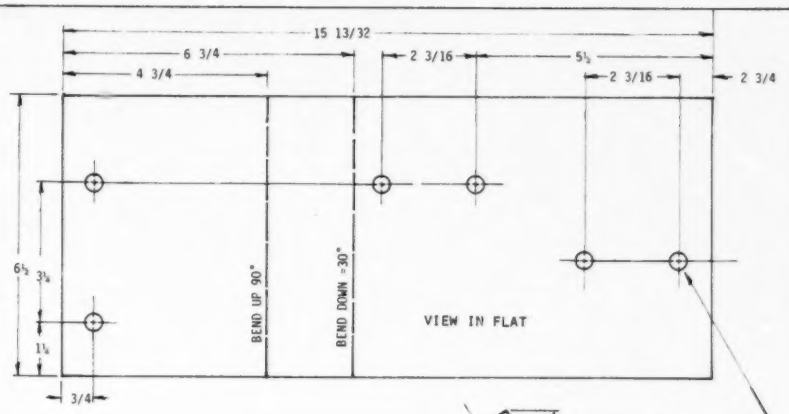


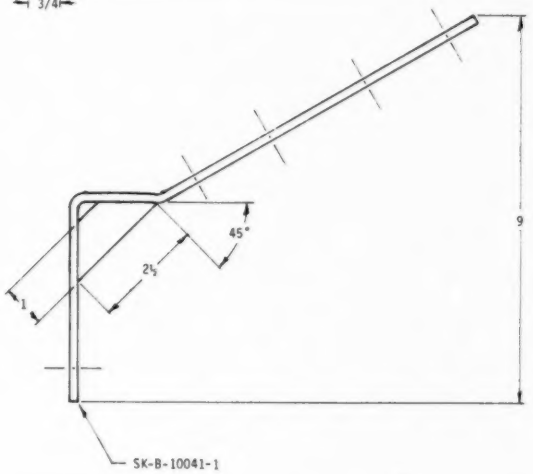
REF	QTY	PART NUMBER	NOMENCLATURE
1	1	1¼"ODx1"x.120 WALL	6061-T6 ALUMINUM PIPE
2	4	SAE TYPE F-16	1½" HOSE CLAMP
3	2	SAE 20R2-2	1¼"IDx2" HEATER HOSE
4	1	1"-R200Sx23"	1"ID FEDERAL S/S FLEX TUBE
5	1	5110384	DETROIT DIESEL BREATHER
6	1	17010	4" DONALDSON GUILLOTINE CLAMP

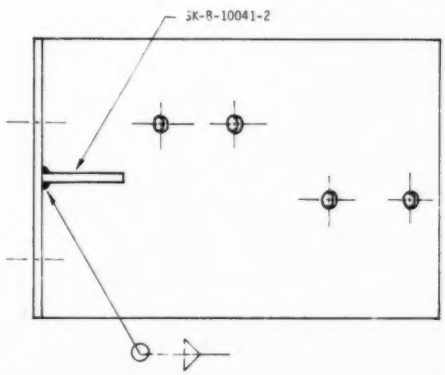
REVISED:

DATE DRAWN: 11-5-81	MATERIAL: AS NOTED	TITLE: CRANKCASE BREATHER INST
DRAWN BY: CHECKED BY:	WHERE USED: 8V-71 IN "NEW LOOK" BUS	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10040

SKA-B-10041



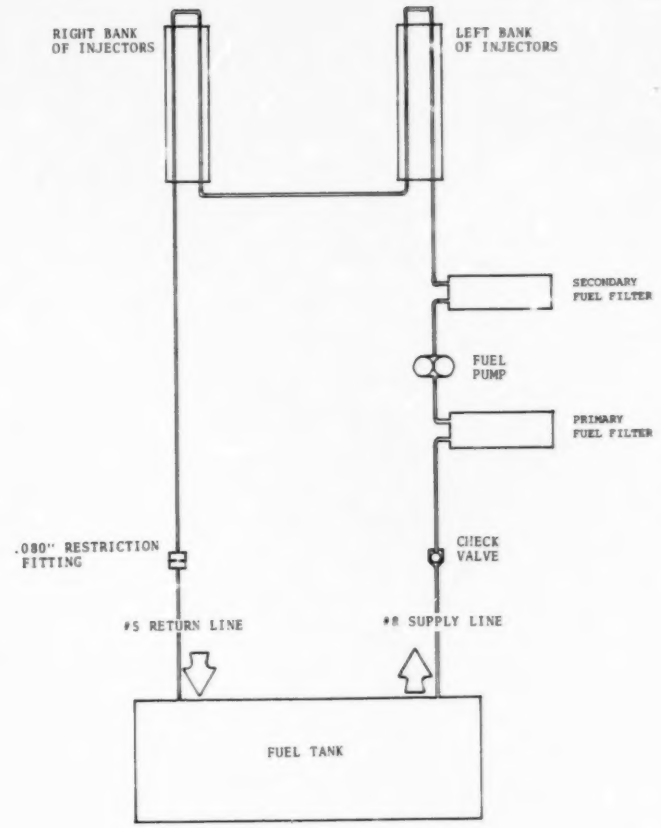




REVISED:

DATE DRAWN: 11-4-81	MATERIAL: 3/16 M.S. PLATE	TITLE: FUEL FILTER BRACKET
DRAWN BY: MK CHECKED BY:	WHERE USED: BUS WITH DETROIT DIESEL ENGINE	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKA-B-10041

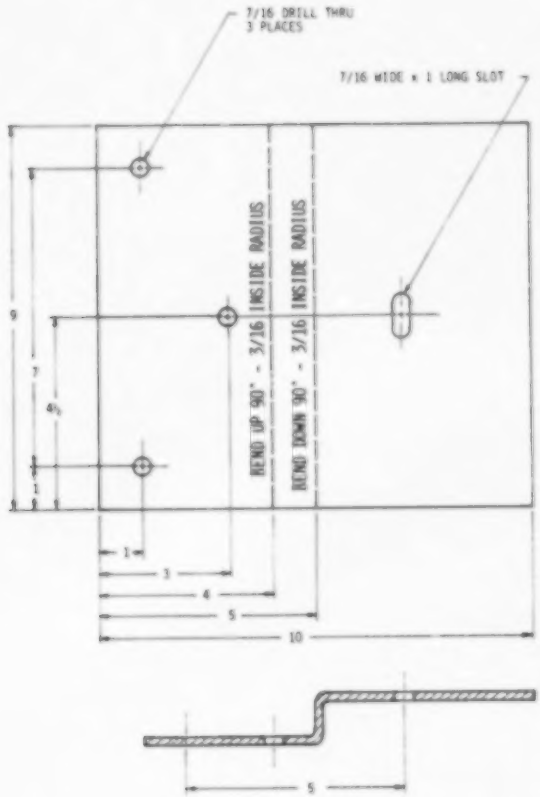
SK-B-10042



REVISED:

DATE DRAWN: 10-24-81	MATERIAL: AS NOTED	TITLE: FUEL SYSTEM SCHEMATIC
DRAWN BY: CHECKED BY:	WHERE USED: NEW LOOK STYLE BUS	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10042

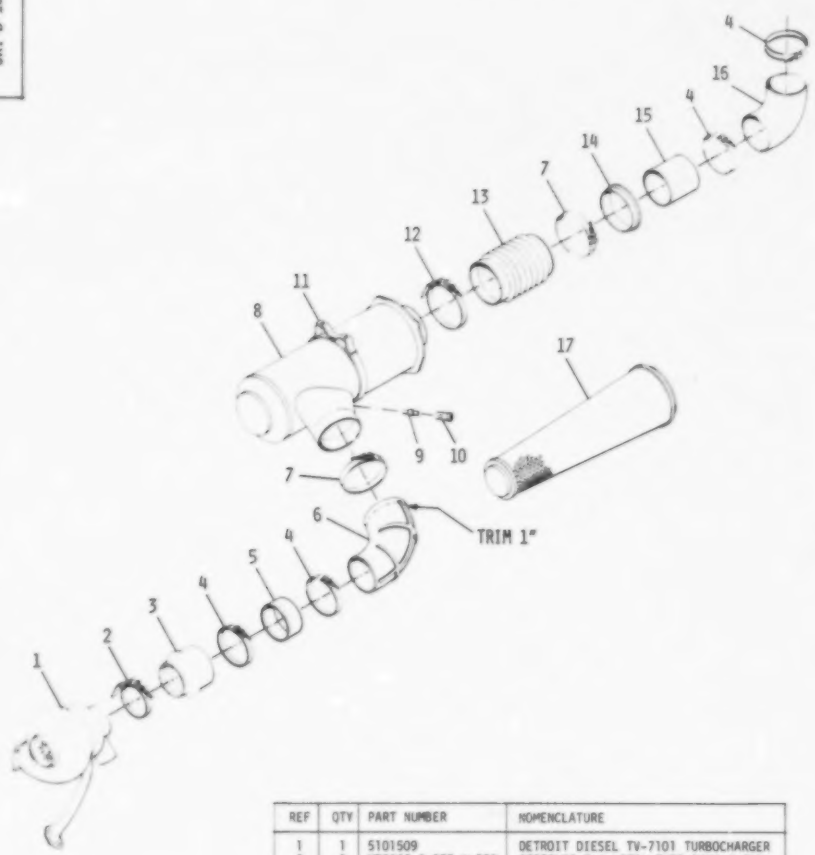
SK-B-10043



NOTE: PRIME BEFORE INST.

DATE DRAWN: 10-30-81	MATERIAL: 3/16 M.S. PLATE	TITLE: MUFFLER MOUNTING ADAPTER
DRAWN BY: CHECKED BY:	WHERE USED: SKA-B-10035	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .030	TRI-MET 4815 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10043

SKI-B-10044

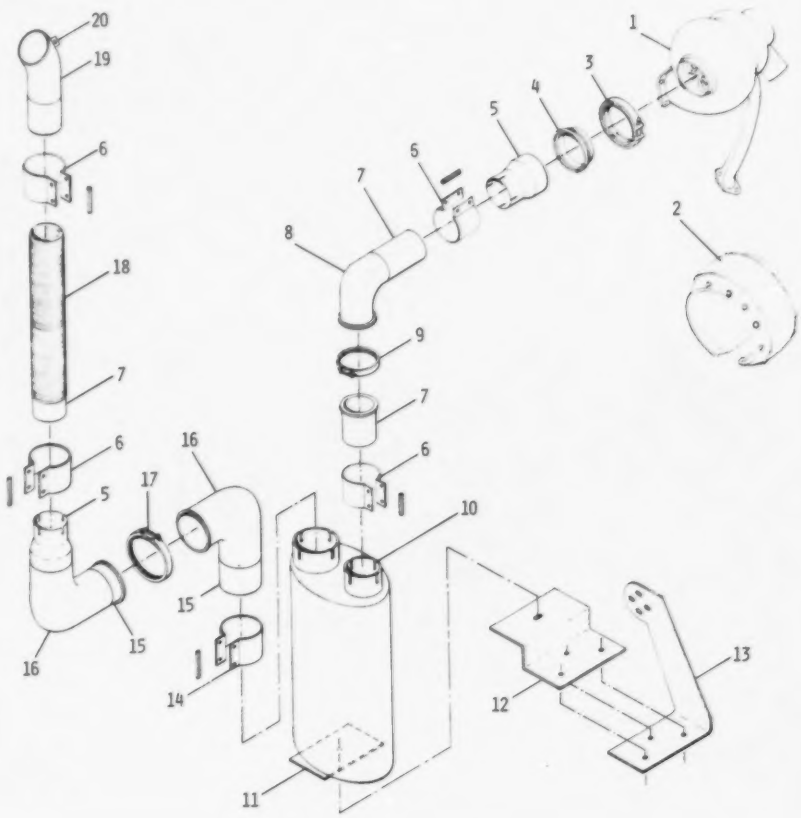


REF	QTY	PART NUMBER	NOMENCLATURE
1	1	5101509	DETROIT DIESEL TV-7101 TURBOCHARGER
2	1	MB9360-S-075-N-550	AEROQUIP 5½" LATCH-TYPE BAND CLAMP
3	1	3H5	HUNTINGTON 5" HUMP HOSE
4	3	55083-550-2	AEROQUIP 5½" BAND CLAMP
5	1	5"ODx3"x.065 WALL	6061-T6 ALUMINUM TUBE
6	1	90HL60R50SR	HUNTINGTON 6-TO-5 90° REDUCING ELBOW
7	2	55083-650-2	AEROQUIP 6½" BAND CLAMP
8	1	EBA 09-2001	DONALDSON KONEPAC® AIR CLEANER
9	1	P10-0089	DONALDSON SAFETY FILTER
10	1	RBX00-2278	DONALDSON SERVICE INDICATOR
11	1	P004073	DONALDSON 9" MOUNTING BAND
12	1	MB9360-S-075-N-650	AEROQUIP 6½" LATCH-TYPE BAND CLAMP
13	1	60R55FLEX1100	HUNTINGTON 6-TO-5½ FLEX CONNECTOR
14	1	99555	HUNTINGTON 5½-TO-5 REDUCER INSERT
15	1	5"ODx6"x.065 WALL	6061-T6 ALUMINUM TUBE
16	1	45HL5	HUNTINGTON 45° ELBOW
17	1	P12-9472	DONALDSON FILTER

REVISED:

DATE DRAWN: 10-26-81	MATERIAL: AS NOTED	TITLE: AIR INTAKE SYSTEM
DRAWN BY: CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10044

SKI-B-10045

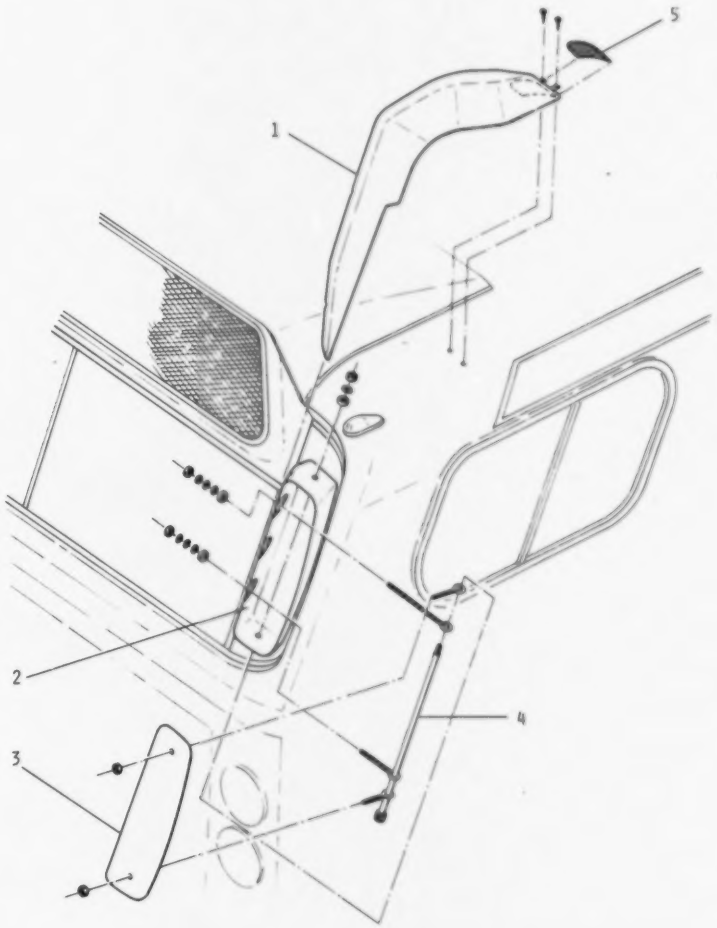


REF	NOMENCLATURE	REF	NOMENCLATURE
1	DETROIT DIESEL TV-7101 TURBOCHARGER	11	MUFFLER MOUNTING PLATE
2	HITCO TURBOCHARGER BLANKET 298S27644	12	MOUNTING PLATE
3	DETROIT DIESEL V-BAND CLAMP	13	MUFFLER HANGER
4	DETROIT DIESEL TURBOCHARGER FLANGE	14	5" SEALCLAMP®
5	5"OD X 4"ID REDUCER	15	5"OD X 16 GAGE M.S. TUBE
6	4" SEALCLAMP®	16	5"OD X 5½"R 90° ELBOW
7	4"OD X 16 GAGE M.S. TUBE	17	5" SERVICEMASTER® JOINT
8	4"OD X 4½" R 90° ELBOW	18	4"ID S/S FLEX TUBE
9	4" SERVICEMASTER® JOINT	19	4"ID X 6"R 45°ELBOW
10	DONALDSON 10"X15" MUFFLER	20	3/16" M.S. TAB

REVISED:

DATE DRAWN: 11-2-81	MATERIAL: AS NOTED	TITLE: EXHAUST SYSTEM
DRAWN BY: CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10045

SKI-B-10046

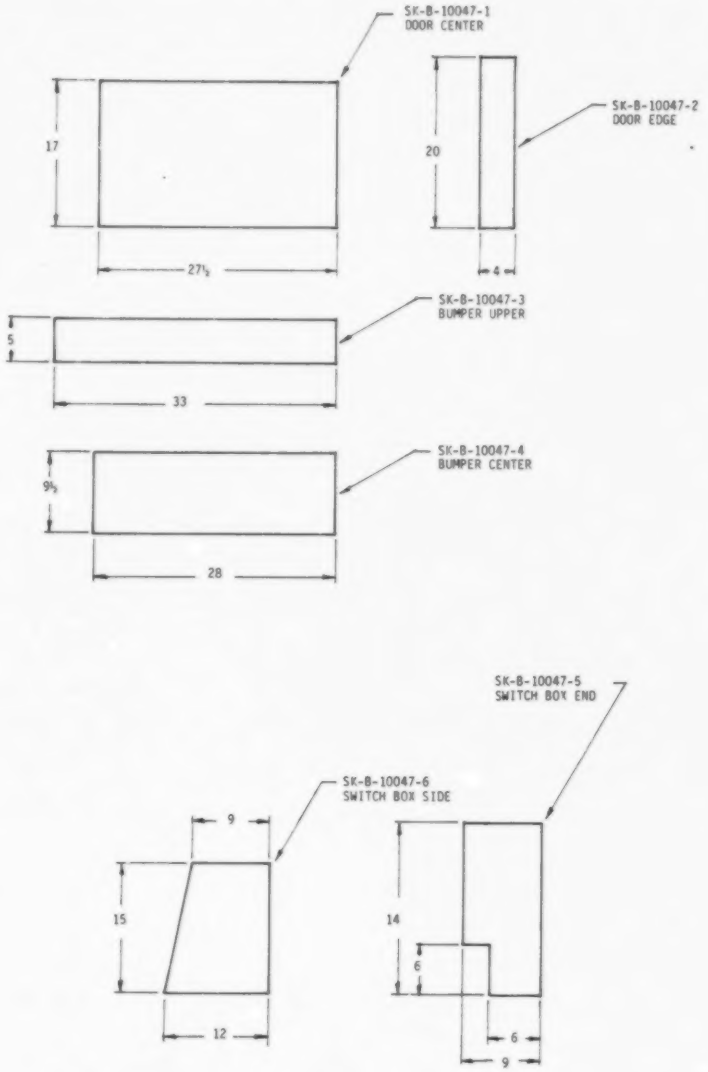


REF	NOMENCLATURE
1	SNORKLE
2	INTAKE COWL
3	COWL BLANK
4	THROUGH-TUBE ASSY
5	INLET SCREEN

REVISED:

DATE DRAWN: 10-24-81	MATERIAL: AS NOTED	TITLE: HOLLOWAY SNORKLE INST.
DRAWN BY: MK CHECKED BY:	WHERE USED: GMC T8H-5037A	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4013 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKI-B-10046

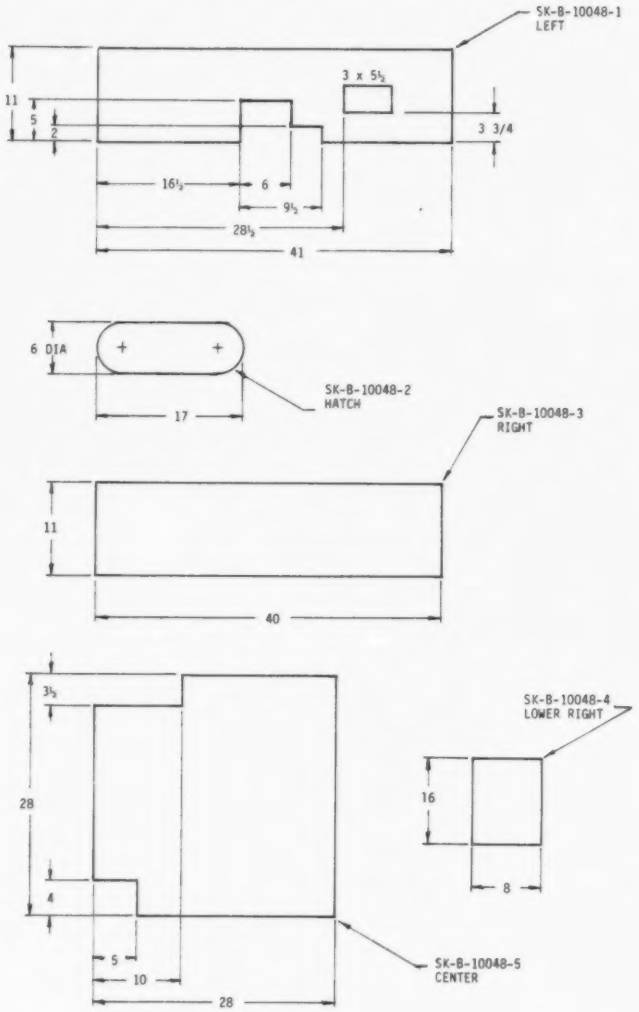
SK-B-10047



REVISED:

DATE DRAWN: 11-1-81	MATERIAL: INSUL-QUILT TYPE 6 - 10 OZ/FT²	TITLE: ENGINE COMPT PADS - RIGHT SIDE
DRAWN BY: CHECKED BY:	WHERE USED: SKI-B-10033	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10047

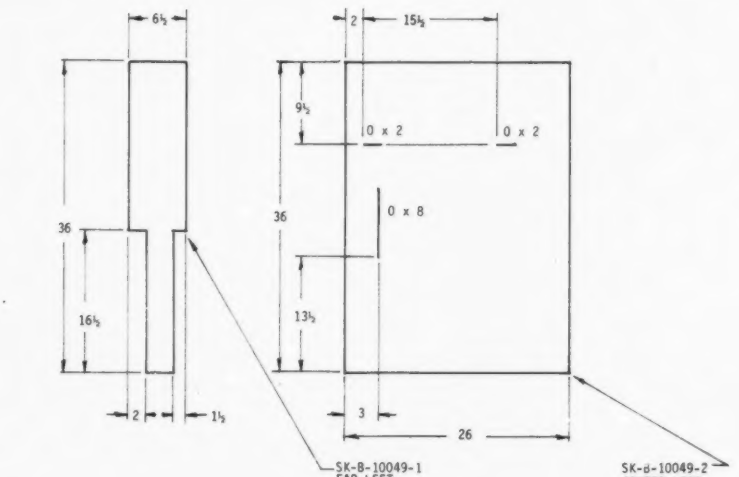
SK-B-10048

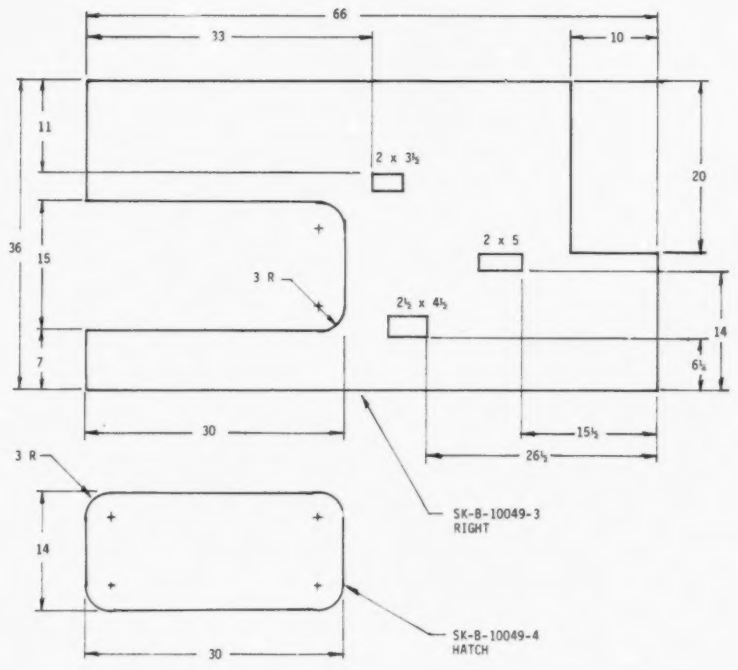


REVISED:

DATE DRAWN: 11-2-81	MATERIAL: INSUL-QUILT TYPE 6 - 10 OZ/FT³	TITLE: ENGINE COMPT PADS -FIREWALL
DRAWN BY: AK CHECKED BY:	WHERE USED: SKI-B-10033	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10048

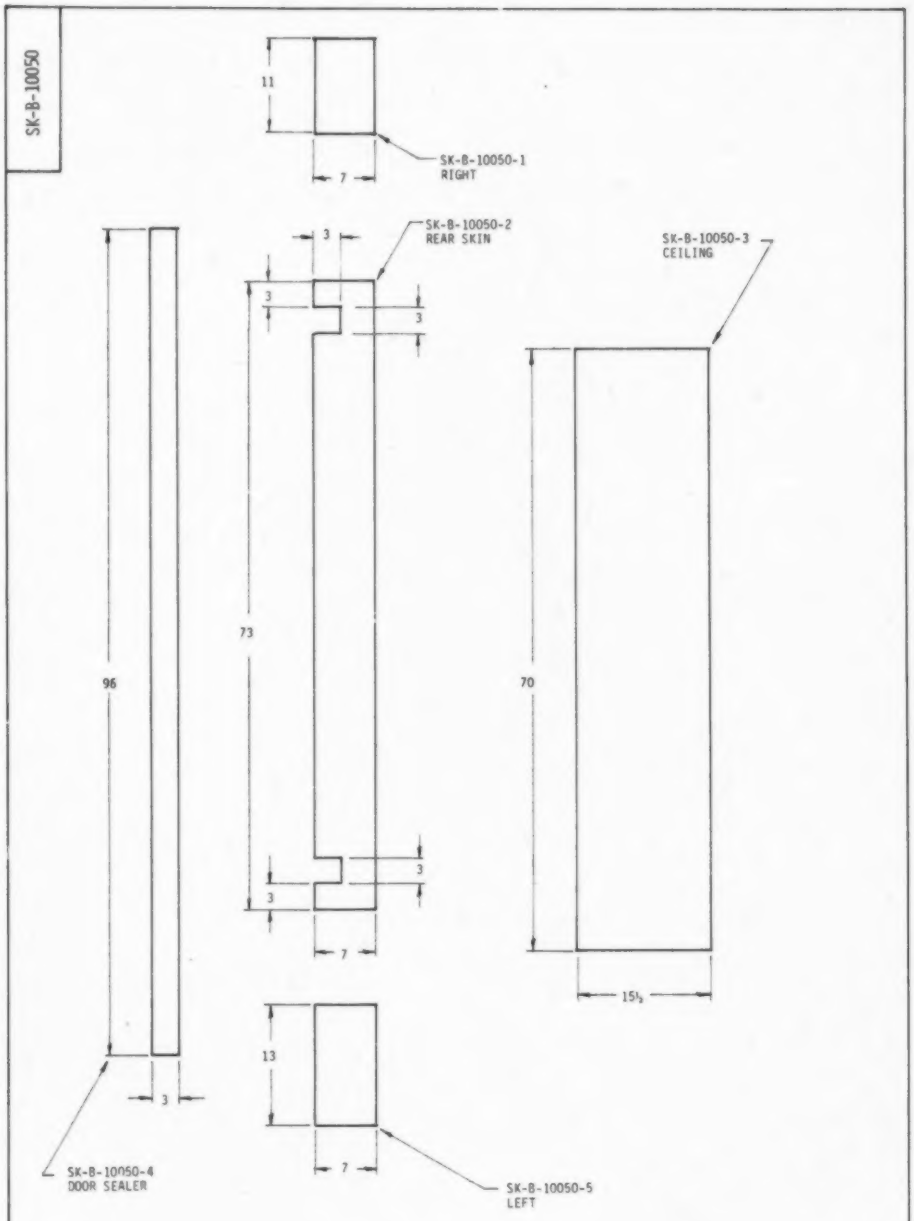
SK-B-10049





REVISED:

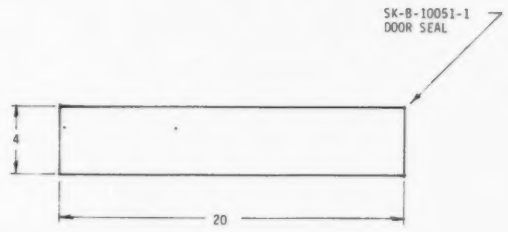
DATE DRAWN: 11-2-81	MATERIAL: INSUL-QUILT TYPE 6 - 10 OZ/FT²	TITLE: ENGINE COMPT PADS -REAR SEAT PAN
DRAWN BY: MK CHECKED BY:	WHERE USED: SKI-B-10033	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10049

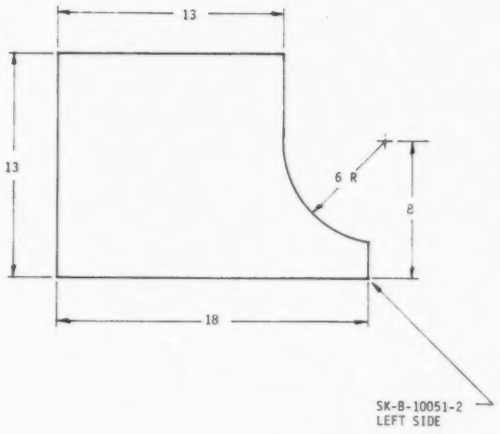


REVISED:

DATE DRAWN: 11-2-81	MATERIAL: INSUL-QUILT TYPE 6 - 10 OZ/FT³	TITLE: ENGINE COMPT PADS -OVERHEAD
DRAWN BY: MK CHECKED BY:	WHERE USED: SKI-B-10033	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .000	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10050

SK-B-10051

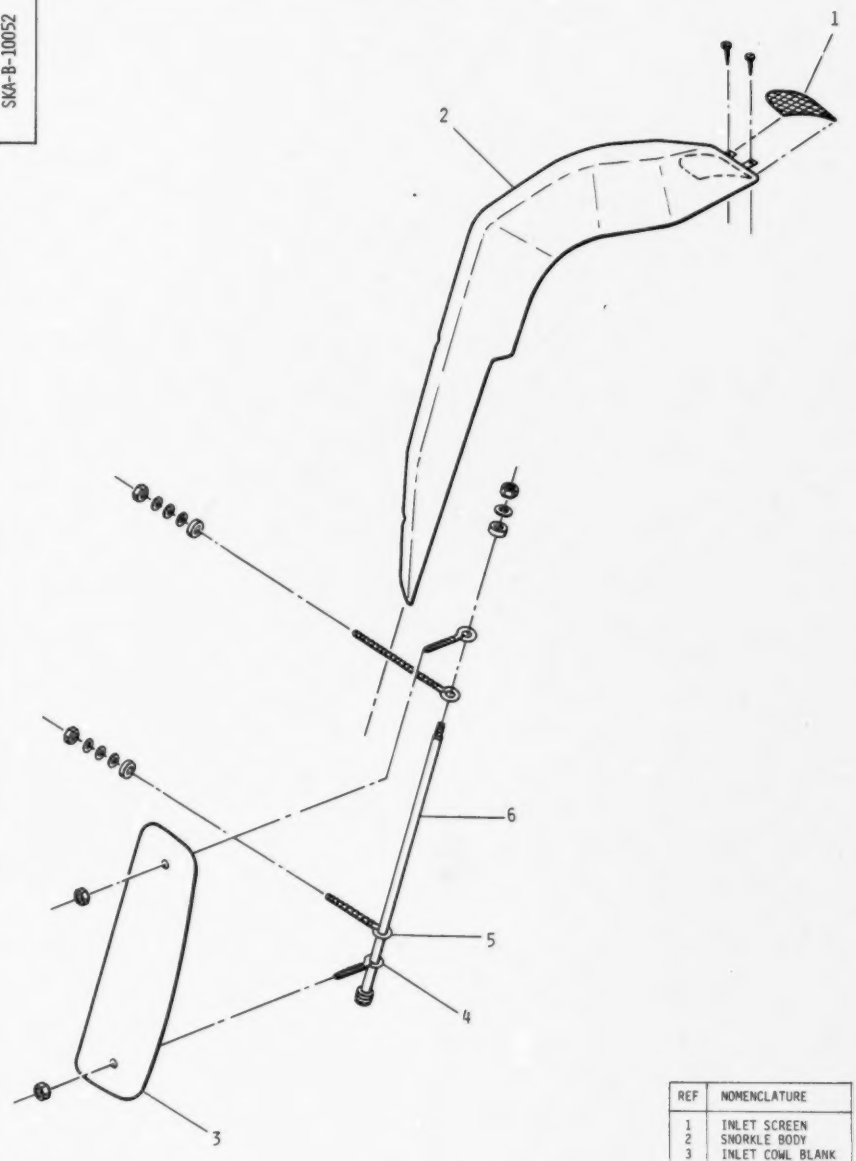




REVISED:

DATE DRAWN: 11-2-81	MATERIAL: INSUL-QUILT TYPE 6 - 10 OZ/FT²	TITLE: ENGINE COMPT PADS -LEFT SIDE
DRAWN BY: CHECKED BY:	WHERE USED: SKI-B-10033	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 4012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SK-B-10051

SKA-B-10052



REF	NOMENCLATURE
1	INLET SCREEN
2	SNORKLE BODY
3	INLET COWL BLANK
4	BLANK EYEBOLTS
5	SNORKLE EYEBOLTS
6	COWL THROUGH-TUBE

REVISED:

DATE DRAWN: 11-4-81	MATERIAL: FIBERGLASS	TITLE: HOLLOWAY SNORKLE KIT
DRAWN BY: CHECKED BY:	WHERE USED: SKI-B-10046	
ALL DIMENSIONS IN INCHES GENERAL TOLERANCES FRACTIONS ± 1/64 DECIMALS ± .005	TRI-MET 6012 S.E. 17TH AVENUE PORTLAND, OREGON 97202	DRAWING NUMBER: SKA-B-10052